INDENTIFING RISK FACTOR FOR LOW OUT COME IN GENERAL SURGICAL PRACTICE USING PORTSMOUTH POSSUM SCORING SYSTEM

dissertation submitted for

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Dr.M.G.R., Medical university
Chennai.

DEPARTMENT OF GENERAL SURGERY,
MADURAI MEDICAL COLLEGE,
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BONAFIDE CERTIFICATE

This is to certify that the dissertation entitled "**IDENTIFING RISK FACTOR FOR LOW OUT COME IN GENERAL SURGICAL PRACTICE USING PORTSMOUTH POSSUM SCORING**" submitted by Dr.M.VENNILA to the Tamil Nadu Dr. M.G.R. Medical University, Chennai in partial fulfillment of the requirement for the award of M.S. Degree Branch I (General Surgery) is a bonafide research work was carried out by him under my direct supervision & guidance.

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DECLARATION

I, Dr.M.VENNILA declare that, I carried out this work on, "IDENTIFING RISK FACTOR FOR LOW OUT COME USING PORTSMOUTH POSSUM SCORING SYSTEM" at the Department of Surgery, Govt. Rajaji Hospital during the period of October 2012 to September 2013. I also declare that this bonafide work or a part of this work was not submitted by me or any others for any award, degree, diploma to any other University, Board either in India or abroad.

This is submitted to The Tamilnadu Dr.M.G.R.Medical University, Chennai in partial fulfillment of the rules and regulations for the M.S. Degree examination in General Surgery.

(Dr.M.VENNILA)

Place : Madurai
Date :

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My family and friends have stood by me during my times of need. Their help and support have been invaluable to this study.

My patients, who form the most integral part of the work, were always kind and cooperative. I pray to God give them courage and strength to endure their illness, hope all of them go into complete remission.

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Place: Madurai.

Date :

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Introduction

The basic aim of any surgical procedure is to reduce in morbidity and mortality rates. By this scoring system, comparing the influence on adverse outcome and also assess the efficiency of that particular procedure and their by provide the quality of care. The risk of post operative morbidity and mortality was predicted by using several scoring system. These scoring system can used for several surgical procedure and also qualitative assessments of different surgeons, hospital and countries possum (physiological and But comparison using crude morbidity and mortality rates is fallacious, because of differences in general health of the local population and variable presentation of the patient's condition. Risk scoring seeks to quantify a patient's risk of adverse outcome based on the severity of illness derived from data available at an early stage of the hospital stay.

The possible outcome of a surgical operation must be determined to cause evolution of more effective treatment regimens. Therefore, there is a need for an accurate risk adjusted scoring system, which should be specific to the patient being studied, should incorporate the influence of

the diagnosis for which he is being subjected for surgery, whether elective or emergency and allow for assessment of variable presentation of each patient, to allow assessment of the efficiency of the particular procedure performed. It should also, be easy to use, fast, and comparable among different patient groups. Such a scoring system would allow for comparison of quality of care provided. It could be used to help set a benchmark acceptable adverse outcome rate for a particular procedure, by comparing the mortality rates among different surgeons. It would also allow for comparison of efficacy of various procedures by comparing the differences in observed to expected mortality rates. It would result in a better and meaningful surgical audit and also help in faster adaptation of a new procedure by comparing the reduction in the observed to expected adverse outcome rate. It could be used in predicting the individual patient's prognosis, influence treatment decisions and help in rationalising regimens.

The Physiological and Operative Severity Scoring system for the enumeration of Morbidity and mortality (POSSUM) has been proposed as a risk adjusted scoring system to allow for direct comparison between the observed and expected adverse outcome rates. It has been called as a surgeon based scoring system. The Portsmouth POSSUM is a

modification of the POSSUM scoring system, incorporating the same variables and grading system, but a different equation, which provides a better fit to the observed mortality rate, which is an important and objective measure of outcome. It has already found use in general, vascular, colorectal, oesophageal and laparoscopic procedures but the studies mostly involved patients in developed countries, where the patient characteristics, presentation and available resources differ from our setup.

Hence, there is a need to test the validity of P-POSSUM scoring system in the Indian scenario where malnourishment is a common problem, presentation frequently delayed and resources limited, all of which can influence the patient's complication rate, even with adequate quality of care provided. Hence, the scoring system should be able to incorporate these factors to predict an accurate mortality rate. The P-POSSUM scoring system, which includes both physiological and operative finding parameters, has been proposed to address these concerns. Therefore, there is a need to test whether the P- POSSUM scoring system is able to effectively address these concerns while arriving at the expected mortality rate in the Indian scenario. Major surgeries (elective and emergency), as defined by the POSSUM scoring system, constitute the important high risk group of patients where, the comparison

of observed to expected mortality rate would be expected to yield significant results and, determination of the possible causes for the adverse outcome in patients who succumb following the surgical procedure, would be more beneficial. This study was undertaken to assess the validity of P-POSSUM scoring system in patients undergoing major surgeries in our setup and, to try to analyse the causes for low outcome in this high risk group.

Aims and Objectives

1) To assess the validity of Portsmouth POSSUM scoring system in predicting anticipated mortality rate and to compare with the actual mortality rate in general surgical patients admitted for major surgical procedure.

2) To assess validity of Portsmouth POSSUM scoring system in identifying risk factors for adverse outcome.

Review of Literature

Copeland G P5 analyzed 62 individual parameters (48 physiological and 14 operative factors) (over a 6 month period) to reduce the number of variables in an effort to create a simple, surgeon based risk adjusted scoring system. Of these, 35 factors were further studied over a 6 month period to produce the final set of 12 physiological and 6 operative factors. Multivariate discriminate analysis was then done to obtain multivariate discriminate function coefficients for each set of variables to produce a 12 factor, 4 grade physiological score and logistic regression analysis was done to derive a 6 factor, 4 grade operative score.

PORTSMOUTH PHISIOLOGICAL AND OPERATIVE SEVERITY SCORE FOR THE ENUMERATION OF MORTALITY AND MORBIDITY (P-POSSUM)

Physiological scoring

	1	2	4	8
Age	<60 yrs	61-70yrs	>70yrs	
Cardiac signs	No failure	Diuretic, Antianginal, Digoxin or Anti hypertentive therapy	Peripheral edema, warfarin therapy	Raised JVP

Chest X ray			Borderline cardiomegaly	Cardiomegaly
Respiratory History Chest x ray	No dyspnoea	Dyspnoea on exertion Mild COAD	Limiting dyspnoea Moderate COAD	Dyspnoea at rest (rate >30/min) Fibrosis or consolitation
Blood Pressure (systolic) (mm of Hg)	110-130	131-170 100-109	>171 90-99	<89
Glasgow coma scale	15	12-14	9-11	<8
Pulse Rate (beats/mt)	50-80	81-100 40-49	101-120	>121 <39
Haemoglibin (g/dl)	13-16	11.5-12.9 16.1-17	10-11.4 17.1-18	<9.9 >18.1
White cell count (X10 12/l)	4-10	10.1-20 3.1-4	>20.1 <3.1	
Urea (mmol/l)	<7.5	7.6-10	10.1-15	>15.1
Sodium (mmol/l)	>136	131-135	126-130	<125
Potassium (mmol/l)	3.5-5	3.2-3.4 5.2-5.3	2.9-3.1 5.4-5.9	<2.8 >6
Electrocardio gram	Normal		Atrial fibrillation(rate 60-90)	Any abnormal rhythm or >5 ectopics/minn, Q waves or ST/T wave changes

Operative scoring

	1	2	4	5
Operative severity	Minor	Moderate	Major	Major +
Multiple procedures	1		2	>2
Total blood loss(ml)	<100 ml	100-500ml	501-1000ml	>1000ml
Peritoneal soiling	None	Minor(serous fluid)	Local pus	Free bowel content,pus or blood
Presence of malignancy	None	Primary only	Nodal metastases	Distant metastases
Mode of surgery	Elective		Emergency resuscitation of >2h possible, Operation <24 h after admission	Emergency (immediate surgery) <2 h needed

Surgery of moderate severity

i) Appendicectomy,

ii) Cholecystectomy

iii) Mastectomy

iv) Transurethral resection of prostate.

Surgery of major severity

i) Laparotomy

ii) Bowel resection,

iii) Cholecystectomy with choledochotomy

iv) Peripheral vascular procedure

v) Major amputation.

Surgery of major+ severity

i) Any aortic procedure

ii) Abdominoperineal resection

iii) Pancreatic or liver resection

iv) Esophagectomy.

It was then applied prospectively in 1,372 patients undergoing general surgeries using logistic regression analysis to obtain statistically significant equations Physiological score (12-88), Operative score (6-48)

For morbidity it was,

Loge [R/1-R] = - 5.91 = (0.16 x physiological score) + (0.19 x operative score)

Where R = risk of morbidity.

For mortality it was,

Loge [R/1-R] = - 7.04 + (0.13 x physiological score) + (0.16 x operative score)

Where R= Risk of mortality.

The predictive value of these equations was assessed and validated by the determination of receiver operating characteristic curves. They concluded by suggesting wider application of the scoring system to assess its validity in other surgeries and different setups. Jones D R23 compared the efficiency of POSSUM and APACHE II scoring systems, in predicting the adverse outcome in 117 patients in a general surgery unit, undergoing major surgery (elective and emergency). Preoperative and intra operative data was collected and patients were monitored for any complications for the first 30 postoperative days. 13 patients (11%) died and the incidence of post operative complications was 50%(. ROC curve analysis was performed to calculate predictive value of POSSUM and APACHE II scoring systems. POSSUM was a good predictor of mortality (area under curve 0.753) and morbidity (area under curve 0.82). APACHE II scoring system showed a poor predictive value) (area under curve 0.54) and a statistically significant difference was seen ($p < 0.002$).Therefore, POSSUM scoring system was recommended as an accurate predictor of post operative adverse outcome.

Copeland G P2 applied POSSUM for comparative audit in 344 patients undergoing reconstructive vascular surgery to assess its efficiency in comparative audit between two units. They were able to demonstrate that POSSUM was a better predictor of adverse outcome following surgery. Estimated mortality rates of 10.2% for unit A (observed 9.4%) and 20.2% for unit B (observed 20.2%) were obtained and using ROC curves they proved that there was no statistically significant difference between the two units. They concluded that POSSUM scoring system was a better guide for comparing efficiency of quality of care, rather than crude mortality rates. Copeland G P6 analysed the basis of comparative audit and suggested POSSUM scoring system to help fulfil the basic need of providing good comparative audit from general surgical patients. Sagar P M1 evaluated feasibility of POSSUM scoring system for predicting adverse outcome rate following colorectal resection and its use for comparative audit. 248 patients undergoing colorectal resection in two different units were studied and POSSUM scoring system was applied. POSSUM predicted mortalityrate of 5.2% in unit A (observed 6%) and 9.8% in unit B (observed 9%) denoting that the observed to expected ratio were nearly identical both the

units. Therefore, they concluded by validating POSSUM scoring system in patients undergoing colorectal surgery and also it's efficacy in comparative audit.

Murray G D3 suggested that statistical remodelling is required for predicting the quality of care and, comparison using crude mortality rates was not a good method. Sagar P M14 used POSSUM scoring system to compare adverse outcome following colorectal resection in 438 patients among five surgeons. While crude mortality rates varied from 5.6% to 6.9% and morbidity rates between 13.6% and 30.6%, risk adjusted analysis using POSSUM showed no statistically significant difference and the overall observed to expected ratio for mortality was found to 0.87 and for morbidity, it was 0.97. They concluded that meaningful comparison of individual surgeon's efficiency was possible as POSSUM is a good predictor of adverse outcome.

Whitely MS7 from Portsmouth University evaluated POSSUM scoring system in 1,485 patients undergoing general surgical procedures. Mortality rate was used to compare the observed and expected rates because of difficulties involved in defining morbidity and collecting data on complications. Mortality is also an objective measure of surgical outcome. The predicted deaths were 90, while the observed deaths were

37. They demonstrated an over prediction of by a factor of 2 using the POSSUM scoring system and linear analysis as described by Hosmer and Lemeshow. Therefore, in order to improve the predictive capability of the scoring system, they used linear regression analysis to derive a better equation, but using the same set of variables as described in the original POSSUM scoring system.

For mortality it was

Loge [R/1-R] = (0.1692 x PS) + (0.155 x OS) - 9.065.

Where R = risk of mortality.

The new modified Portsmouth POSSUM scoring system was then created, which provided a better it to the observed mortality rate (O: E ratio 1, *x2* test 5.84, d.f., p = 0.1197).They concluded by suggesting geographical comparison of POSSUM, which could result in better application of risk adjusted scoring system as was done in their case.

Wijesinghe10 compared POSSUM and Portsmouth POSSUM (PPOSSUM) for predicting mortality following vascular surgery in 312 consecutive patients. Data regarding the first 30 day post operative period was collected which revealed 41 deaths. Analysis was done using linear and exponential methods for POSSUM and P-POSSUM, respectively. Using the POSSUM scoring system they obtained an

observed to expected ratio of 0.59 using linear analysis and 1.14 using exponential analysis. P-POSSUM revealed an observed to expected ratio of 0.89 using linear analysis, which was simpler and could predict the individual patient's mortality rate. They concluded that POSSUM and PPOSSUM are accurate in predicting the mortality rate if the correct method of analysis was used for each system and the scoring systems were valid not only in general but also in vascular surgery.

Prytherch D R8 prospectively compared POSSUM and P-POSSUM in 10,000 general surgical patients between August 1993 and November 1995. The POSSUM scoring system was applied to all 10,000 patients, while the first 1,500 patients were used to derive a modified P-POSSUM equation, which was then applied prospectively to the remaining cases. While the POSSUM scoring system over predicted the mortality rate by a factor of 2, the observed mortality rate being 287deaths and predicted was 697 deaths, the P-POSSUM scoring system when applied prospectively on the subsequent 7,500 cases showed an observed to expected ratios of 0.90 ($x2$ =1.63 5 d.f.,) and 0.85 ($x2$ =1.35 4 d.f.). They concluded by suggesting application of P-POSSUM scoring system for predicting mortality and also emphasised the need for

evaluation of geographical variation in predicting the adverse outcome rate.

Menon K V24 evaluated P-POSSUM for analysing the outcome of methicillin resistant staphylococci aureus infected cases undergoing surgery in 1132 patients of which 30 were diagnosed to be infected by methicillin resistant staphylococci aureus. The outcome was compared to the other non infected group having similar predicted mortality rate as per P-POSSUM. There was not found to be any statistical difference between the two groups. They therefore validated PPOSSUM as a means of standardising patient data so that comparison can be made amongst diverse groups of patients.

Jones H J S and de Cossart L4 performed a Meta analysis of the various scoring systems available for risk scoring in surgical patients by comparing ASA, Goldman cardiac index, prognostic nutritional index, hospital prognostic index, APACHE -II, POSSUM and P-POSSUM scoring systems. They suggested that POSSUM and P-POSSUM scoring systems could be used because of their easy applicability, usage of routine preoperative investigations and could serve as an important risk scoring tool.

Midwinter11 compared POSSUM and P-POSSUM for assessing mortality and morbidity rates in patients undergoing vascular surgery. 221 patients undergoing elective and emergency vascular surgeries by a single consultant were studied. Overall mortality and morbidity rates were 6.6% and 57.6% respectively. While the POSSUM scoring system showed a significant difference between observed and expected mortality rates (*x2* test =24.04, 6 d.f., p <0.001), P-POSSUM scoring system showed good concordance between expected and observed mortality rates (*x2* test =9 6 d.f., p = .17).They concluded that POSSUM is a better predictor of post operative mortality rates and also suggested widespread application among different regions to assess its validity and if a good fit was obtained; the equation could be adopted as a standard for risk adjusted comparative audit as well as, enabling an individual surgeon or unit to assess the effectiveness of care provided.

Treharne G D12 used the physiological component of POSSUM scoring system to compare outcome among patients undergoing abdominal aortic aneurysm repair by conventional and endovascular procedures. 104 consecutive open surgery cases and 49 endovascular surgery patients were included in the study. P-POSSUM scoring system was used to match the two diverse groups of patients to achieve

comparability among the cohorts. Even though the indications for the type of surgery depended upon the patient's physiological status, using PPOSSUM they were able to match the two groups.

The O: E ratios of 0.75 and 0.86 for open and endovascular groups served to validate P-POSSUM scoring system for predicting the mortality rate, allowing the authors to conclude that endovascular method is better than conventional method. Tekkis P15 analysed mortality in patients undergoing gastrointestinal surgery using POSSUM and P-POSSUM scoring systems. A total of 505 consecutive patients undergoing major gastrointestinal surgeries (elective 66.1%,emergency 33.9%) were analysed. The observed mortality rate was 56 deaths, while the expected mortality rate using POSSUM was 108 deaths, which was found to be a significant over prediction ($x2$ test = 44.82, 4 d.f., $p<0.001$). Using P-POSSUM, the expected rate was 57 ($x2$ test =3.34, 4 d.f., $p = 0.51$). Comparison suggests P-POSSUM as the recommended scoring system for risk adjusted performance measurement. Neary B13 in a retrospective study used the physiological part of POSSUM to predict the adverse outcome rate following intra arterial thrombolysis of acute leg ischemia, which is a non operative method. It was found at the physiological

component of POSSUM accurately predicted the adverse outcome rate. They suggested application of POSSUM even in non operative cases.

Bann S D and Sarin S25 assessed the applicability of POSSUM using the hospital based protocols for investigations and excluded patients with incomplete data. They found there was a significant lack of fit to the observed mortality rate and suggested clarifications regarding applicability of POSSUM and P- POSSUM in general surgical patients.

Organ N26 in a retrospective study, evaluated P-POSSUM in 221 patients who had underwent surgery to test its effectiveness in the Australian scenario. Assessment was done using linear analysis and ROC curves. They found a significant difference between the observed mortality rates (28) and the predicted rates (49.9). They concluded that the discordance was too high to warrant the applicability of P-POSSUM for routine assessment of expected mortality rates and suggested further studies for local calibration to arrive at a more effective risk adjusted scoring system in Australian conditions.

Yii M K and Ng K J19 evaluated POSSUM and P-POSSUM scoring systems for prediction of mortality rates among patients undergoing general surgery in a tertiary referral hospital in Malaysia, to assess its applicability in their scenario of a developing country. The

observed rates among four different risk subsets were 6.1%, while the POSSUM system predicted 10.5% showing a significant difference ($p < 0.01$). The predicted mortality using P-POSSUM was 4.8% which showed a good fit to the observed rate. They concluded by validating P-POSSUM as an effective tool for predicting the adverse outcome rate in the Malaysian scenario and, suggested further studies to validateP-POSSUM, especially in other developing countries to allow for accurate comparison of data.

Copeland G P27 explained the genesis of the POSSUM scoring system and described the correct analysis method. He suggested usage of POSSUM scoring system to identify high risk patients who could be benefited from preoperative and preoperative optimisation to provide better surgical care to the patients. He concluded by suggesting wider application of POSSUM in various surgical specialties and other countries to assess the quality of care by using the difference in the O: E rate

Zafirellis K D17 tested the applicability of POSSUM scoring system for assessing mortality rates in patients of oesophageal, undergoing oesophagectomy. A total of 204 patients were studied retrospectively and analysed using linear method of analysis.

The observed and expected mortality rates were 12.7% and 19.1% respectively, showing a poor assessment of mortality rate prediction. They concluded that POSSUM scoring system required to be recalibrated to allow better prediction of mortality rates in their study group.

Shuhaiber J H28 compared POSSUM and P-POSSUM in predicting mortality rates following infra renal abdominal aortic aneurysm repair. 118 patients were included and outcomes compared using POSSUM, P-POSSUM and length of hospital stay hypothesis. The O: E ratio was 1.24 for POSSUM and 0.71 for P-POSSUM. They concluded by validating P-POSSUM and POSSUM for prediction of post operative mortality rate.

Neary W D29 performed a Meta analysis of POSSUM and its modifications using Medline, Cochrane library and Embase databases. A description of the genesis of POSSUM was given, its method of application and analysis. They described the exponential method of analysis which is the recommended method and also its limitations with respect to its complexity and its inability to predict the individual risk of adverse outcome. A description of the P-POSSUM system was given and its results in various studies were highlighted. The limitations of these studies were described; regarding missing data and the timing of

physiological scoring. The controversy regarding the recommended investigations was also cleared. The lack of facilities for accurate measurement of the total blood loss was explained to be not significant to alter the final score. The applicability of POSSUM in general surgery and its evolution for individual specialties was described and studies reviewed. A comparative analysis of P-POSSUM and APACHE II was given and its superiority was stressed upon. The authors concluded by validating POSSUM as an important comparative surgical audit tool.

Tekkis P16 evaluated POSSUM and P-POSSUM in a prospective study in 1,017 patients undergoing colorectal surgery. The observed mortality rate was 7.5%,while the predicted rates by POSSUM and P-POSSUM were 8.2% and7.1% respectively. They found an over prediction in the young patients ($p < 0.001$) and under prediction in emergency cases and elderly patients ($p < 0.05$).They have suggested recalibration in these groups of patients undergoing colorectal surgery.

Bennent-Guerrero E9 used P-POSSUM scoring system to compare mortality rates among surgeries performed in the USA and UK. Prospective analysis of two cohorts in the USA (n = 1,056) and UK (n = 1,539) was done. POSSUM scoring system expected mortality rates showed significant fit to the observed mortality rates in the UK (156 and

152) and in the USA (82 and 22). They were able to show a better outcome among patients undergoing surgeries in the USA when compared to those in the UK (Odds ratio = 4.5, $p < 0.001$). They concluded by validating P-POSSUM as a predictor of post operative mortality rates and therefore, as a valid system of surgical audit to compare outcome among surgical systems in two different countries Mohil R S20 compared POSSUM and P-POSSUM for predicting the adverse outcome rate in patients undergoing emergency laparotomy. 120 patients who underwent emergency laparotomy at Safdarjang hospital, Delhi, were studied prospectively to assess the applicability in their setup. All patients had physiological scoring done at the time of admission and intra operative scoring was done to obtain the operative scoring variables, to calculate expected 30 daymorbidity and mortality rates. Sixteen patients (13.3%) died within 30 days of surgery and 62 (51.7%) developed significant complications. On analysis, they found an O: E ratio of 0.62 for POSSUM ($x2$ test = 10.79, 9 d.f., $p = 0.148$) and 0.66 using P-POSSUM ($x2$ test = 5.33, 9 d.f., $p = 0.619$).

They concluded by validating POSSUM and P-POSSUM scoring systems for accurate prediction of post operative mortality rates even in the Indian scenario, where the patients usually belonged to the low

socioeconomic strata with very limited resources. POSSUM and P-POSSUM scoring systems can be used to help remove any bias in the patient selection and serve as important methods for predicting the post operative adverse outcome rate, even in their setup.

Parihar V21 performed a risk adjusted audit of low risk general surgical patients using the POSSUM and P-POSSUM scoring systems in 788 patients. They found good prediction of mortality using POSSUM (O: E ratio = 0.94) and P-POSSUM (O: E ratio = 1.525). In an effort to reduce the over prediction in low risk general surgical patients, they performed multi variate regression analysis to obtain a new equation called Jabalpur POSSUM (J-POSSUM), which provided a better fit to the observed mortality and morbidity rates (O:E ratio = 1.04) in low risk general surgical patients.

They validated POSSUM, P-POSSUM and JPOSSUM in predicting the adverse outcome rates in general surgical patients in the Indian setup.Tambyraja A L18 evaluated

POSSUM scoring system in predicting outcome after laparoscopic cholecystectomy in 76 patients aged over 80 years. They found an O: E ratio of 1 for morbidity and 0 for mortality. They concluded by approving POSSUM scoring system and suggested further correction for

predicting mortality following other laparoscopic procedures. Lam C M30 were able to validate P-POSSUM scoring system among patients undergoing hepatectectomy for hepatocellular carcinoma in China for predicting mortality (O: E ratio = 1.4 *x2* test =7.6, 3 d.f., p = 0.055). Gatt M31 used POSSUM scoring system to randomise two groups of patients undergoing major colonic resection in a randomised controlled trial to evaluate multi modal optimisation of surgical care.

Brooks M S32 compared POSSUM, P-POSSUM and surgical risk score among 949 patients undergoing general surgical procedures. They obtained a significant fit for predicting post operative mortality using P-POSSUM (observed and expected rates being 7.3 and 8.4 respectively) and surgical risk scoring system (5.9 and 8.4). They concluded by validating both the scoring systems for predicting post operative mortality rates.

Methodology

Source of data:

This prospective study was carried out on patients undergoing major general surgical procedures admitted in the department of general surgery of GOVERNMENT RAJAJI HOSPITAL, MADURAI MEDICAL COLLEGE, MADURAI

Study period:

The study period was from NOVEMBER 2012 to OCTOBER 2013 and the period of follow up was 30 days following the surgical procedure.

Method of collection of data:

Patients admitted under general surgery and scheduled to undergo major surgical procedures were scored according to their physiological and operative findings using a proforma sheet (Annexure I)

Inclusion criteria:

Patients undergoing any of the following major surgical procedures as defined by the POSSUM scoring system,

1. Any laparotomy
2. Cholecystectomy with choledochotomy
3. Bowel resection
4. Major amputation
5. Peripheral vascular procedure

Exclusion criteria:

1. Age less than 12 years
2. Day care surgery
3. Follow up period criteria not met.
4. All minor, moderate, major+ surgeries as defined by POSSUM scoring systems.

Patients were informed regarding the aims and objectives of study and a detailed informed written consent was taken prior to inclusion into the study. The study protocol was approved by the local ethical clearance committee of this hospital. During hospitalisation relevant history was collected and appropriate investigations as deemed necessary were done using standard procedures. The patients were then scored depending on

their physiological parameters and the intra operative findings were noted and a final expected mortality rate was calculated

PORTSMOUTH PHYSIOLOGICAL AND OPERATIVE SEVERITY SCORE FOR THE ENUMERATION OF MORTALITY AND MORBIDITY (P-POSSUM)

Physiological scoring

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Age	<60 yrs	61-70yrs	>70yrs	
Cardiac signs Chest X ray	No failure	Diuretic, Antianginal, Digoxin or Anti hypertentive therapy	Peripheral edema, warfarin therapy Borderline cardiomegaly	Raised JVP Cardiomegaly
Respiratory History Chest x ray	No dyspnoea	Dyspnoea on exertion Mild COAD	Limiting dyspnoea Moderate COAD	Dyspnoea at rest (rate >30/min) Fibrosis or consolitation
Blood Pressure (systolic) (mm of Hg)	110-130	131-170 100-109	>171 90-99	<89
Glasgow coma scale	15	12-14	9-11	<8
Pulse Rate (beats/mt)	50-80	81-100 40-49	101-120	>121 <39

Haemoglibin (g/dl)	13-16	11.5-12.9 16.1-17	10-11.4 17.1-18	<9.9 >18.1
White cell count (X10 ^{12}/l)	4-10	10.1-20 3.1-4	>20.1 <3.1	
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Sodium (mmol/l)	>136	131-135	126-130	<125
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Electrocardio-gram	Normal		Atrial fibrillation(rate 60-90)	Any abnormal rhythm or >5 ectopics/min, Q waves or ST/T wave changes

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	1	2	4	5
Operative severity	Minor	Moderate	Major	Major +
Multiple procedures	1		2	>2
Total blood loss(ml)	<100 ml	100-500ml	501-1000ml	>1000ml
Peritoneal soiling	None	Minor(serous fluid)	Local pus	Free bowel content,pus or blood

Presence of malignancy	None	Primary only	Nodal metastases	Distant metastases
Mode of surgery	Elective		Emergency resuscitation of >2h possible, Operation <24 h after admission	Emergency (immediate surgery) <2 h needed

lhysiological score (12-88), Operative score (9-44)

For mortality it is,

Loge [R/1-R] = (0.1692 x PS) + (0.155 x OS) - 9.065.

Where R = risk of mortality8.

The patients were then followed up for a period of 30 days following the surgical procedure and complications if any, were noted depending upon the following criteria as defined for POSSUM scoring systems.

Wound haemorrhage:

Local haematoma requiring evacuation.

Deep haematoma:

Postoperative bleeding requiring re-exploration.

Chest infection:

Production of purulent sputum with positive bacteriological cultures,with or without chest radiography changes or pyrexia, or consolidation seen on chest radiograph.

Wound infection:

Wound cellulitis or the discharge of purulent exudate.

Urinary infecion

The presence of > 105 bacteria/ml with the presence of white cells in the urine, in previously clear urine.

Deep infection:

The presence of an intra-abdominal collection confirmed clinically or radiologically.

Septicaemia:

Positive blood culture.

Pyrexia of unknown origin:

Any temperature above 370 Celsius for more than 24 hours after the original pyrexia following surgery (if present) had settled, for which no obvious cause could be found.

Wound dehiscence:

Superficial or deep wound breakdown.

Deep venous thrombosis and pulmonary embolus:

When suspected, confirmed radiologically by venography or ventilation/perfusion scanning, or diagnosed at post mortem.

Cardiac failure:

Symptoms or signs of left ventricular or congestive cardiac failure, which required alteration from preoperative therapeutic measures.

Impaired renal function:

Arbitrarily defined as increase in blood urea > 5mmol/l from preoperative levels.

Hypotension:

A fall in systolic blood pressure below 90 mmHg for more than 2 hours as determined by sphygmomanometry or arterial pressure transducer measurement.

Respiratory failure:

Respiratory difficulty requiring emergency ventilation.

Anastomotic leak:

Discharge of bowel content via the drain, wound or abnormal orifice.

Statistical methods:

The expected mortality rate was obtained using linear regression analysis and the O: E ratio was calculated. Chi square test was then applied to obtain the p value to note any significant difference between the predicted death rate and the actual outcome. Rate of increment in deaths for each risk factor was calculated based on the hypothesis that deaths were linearly related with the score for each of the studied risk factors and‘t’ test was applied to validate this hypothesis.

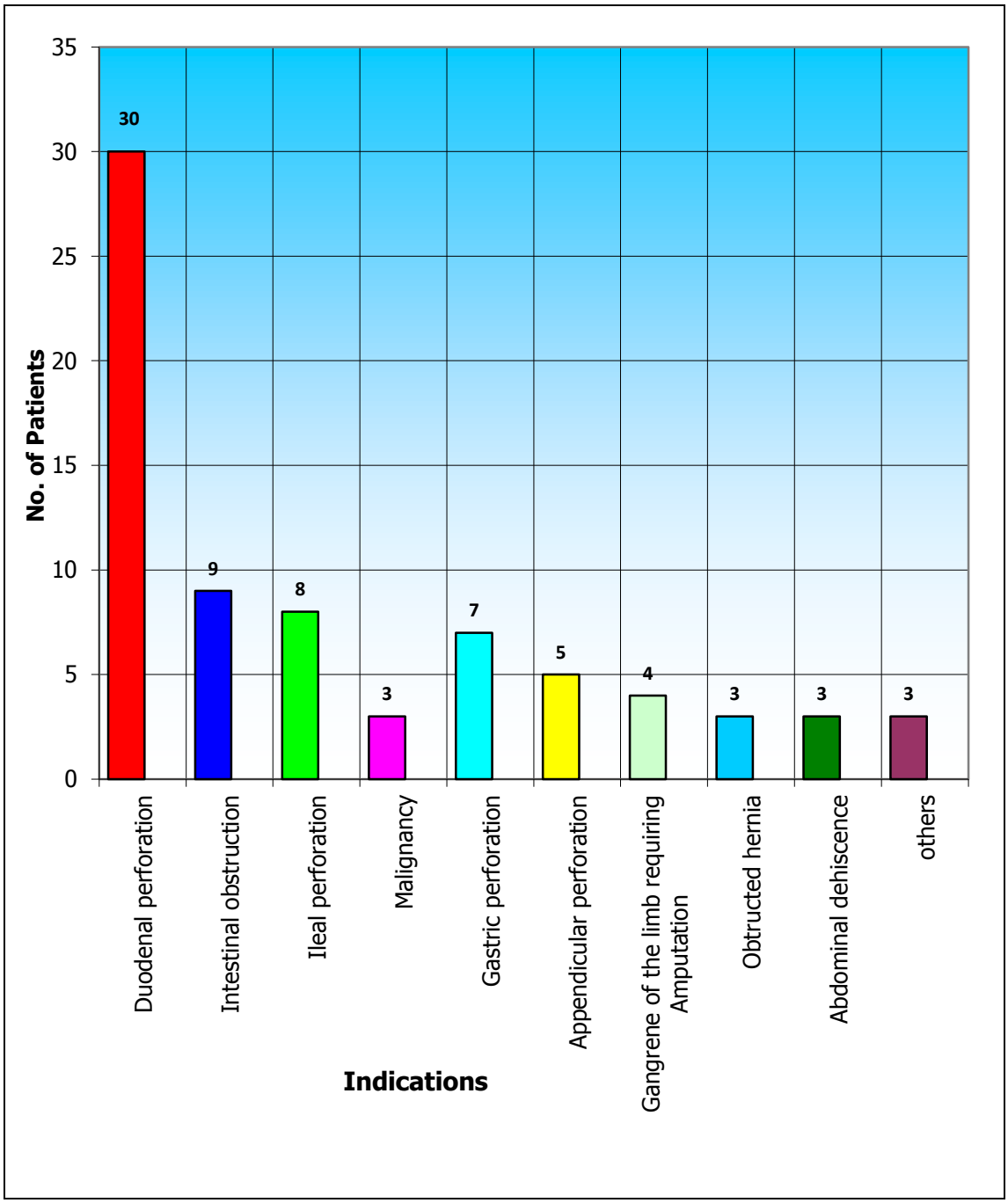
Results

A total of seventy five patient undergoing major surgery in government Rajaji hospital during the period of November 2012 to October 2013 were included in the study protocol. Twenty patients underwent two major surgical operations. There were 55emergency and 20 elective procedures.

Table 1. Indications

Sl.No	Indications	No.of patients
1.	Duodenal perforation	30
2.	Intestinal obstruction	9
3.	Ileal perforation	8
4.	Malignancy	3
5.	Gastric perforation	7
6.	Appendicular perforation	5
7.	Gangrene of the limb requiring Amputation	4
8.	Obtructed hernia	3
9.	Abdominal dehiscence	3
10	Others	3
	Total	**75**

Graph 1. Indications

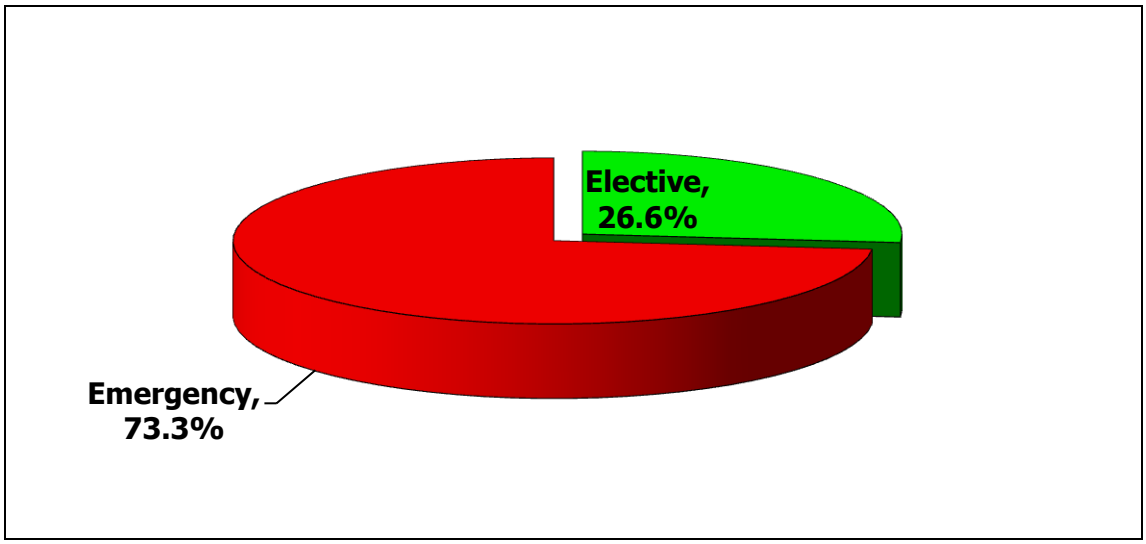


Mode of surgery:

There were 55 emergency and 20 elective surgeries performed. This is represented in the following graph 2

ELECTIVE	**26.6%**
EMERGENCY	**73.3%**

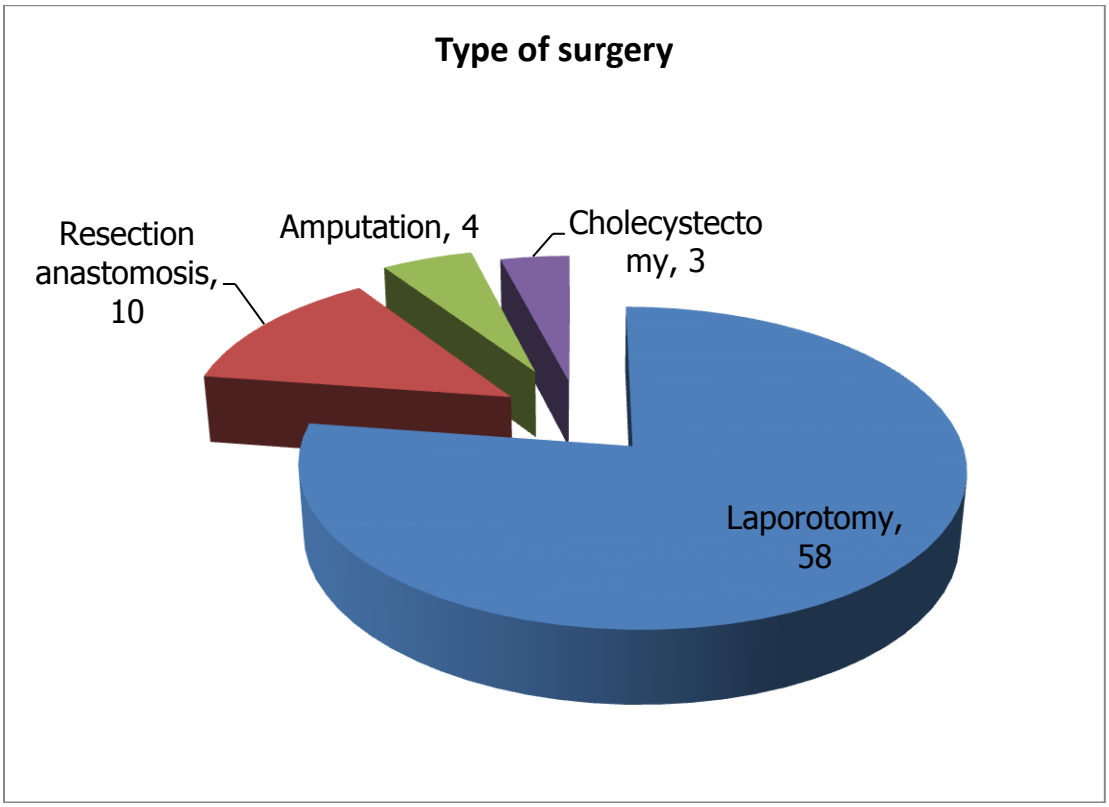
Graph 2. Mode of surgery



Types of major surgeries performed:

There were four types of major surgeries performed in our group, there are laporotomy, resection anastomosis, major amputation and cholecystectomy represented in Graph 3.

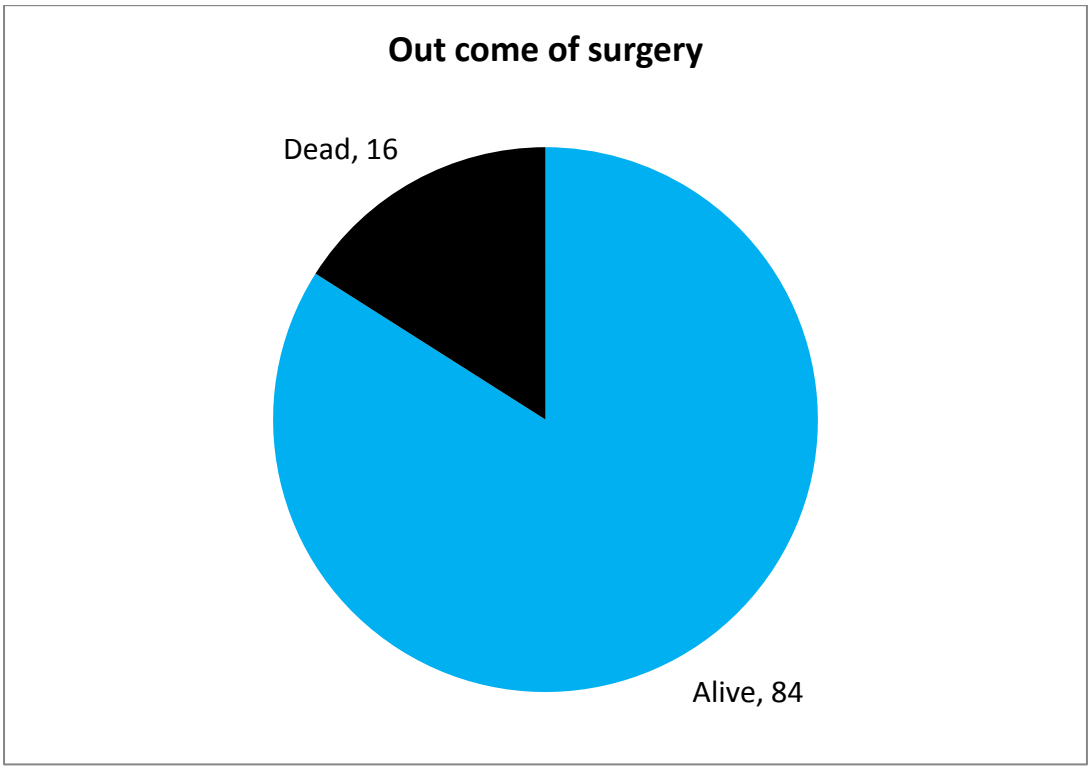
Graph 3. Type of surgeries



Outcome of surgery:

Of the 75 procedures studied, 12 of them were associated with death of the patient resulting in crude mortality rate of 16% represented in graph 4.

Graph 4. Outcome of surgery



Observed: Expected mortality rate:

Comparison of observed and P-POSSUM predicted mortality rates was done using linear analysis represented in table 2 and graph 5. An observed to expected ratio (O: E) of 0.96 was obtained and there was no significant difference between the predicted and observed values (P = 0.048).

Table 2.Comparison of observed and expected mortality rate

Predicted Mortality rate (%)	No. of procedure	Observed No. of deaths (o)	Expected No. of deaths (E)	O:E
<10	45	1	3	0.33
>10 to <20	10	1	1	1
>20 to <30	6	1	1	1
>30 to <40	4	1	1	1
>40 to <50	3	2	2	1
>50 to<60	2	1	1	1
>60 to <70	2	2	1	2
>70 to <80	1	1	1	1
>80 to>90	1	1	1	1
>90 to<100	1	1	1	1
Total	**75**	**12**	**13**	**0.96**

Graph 5. Comparison of observed and expected mortality rates

Complications:

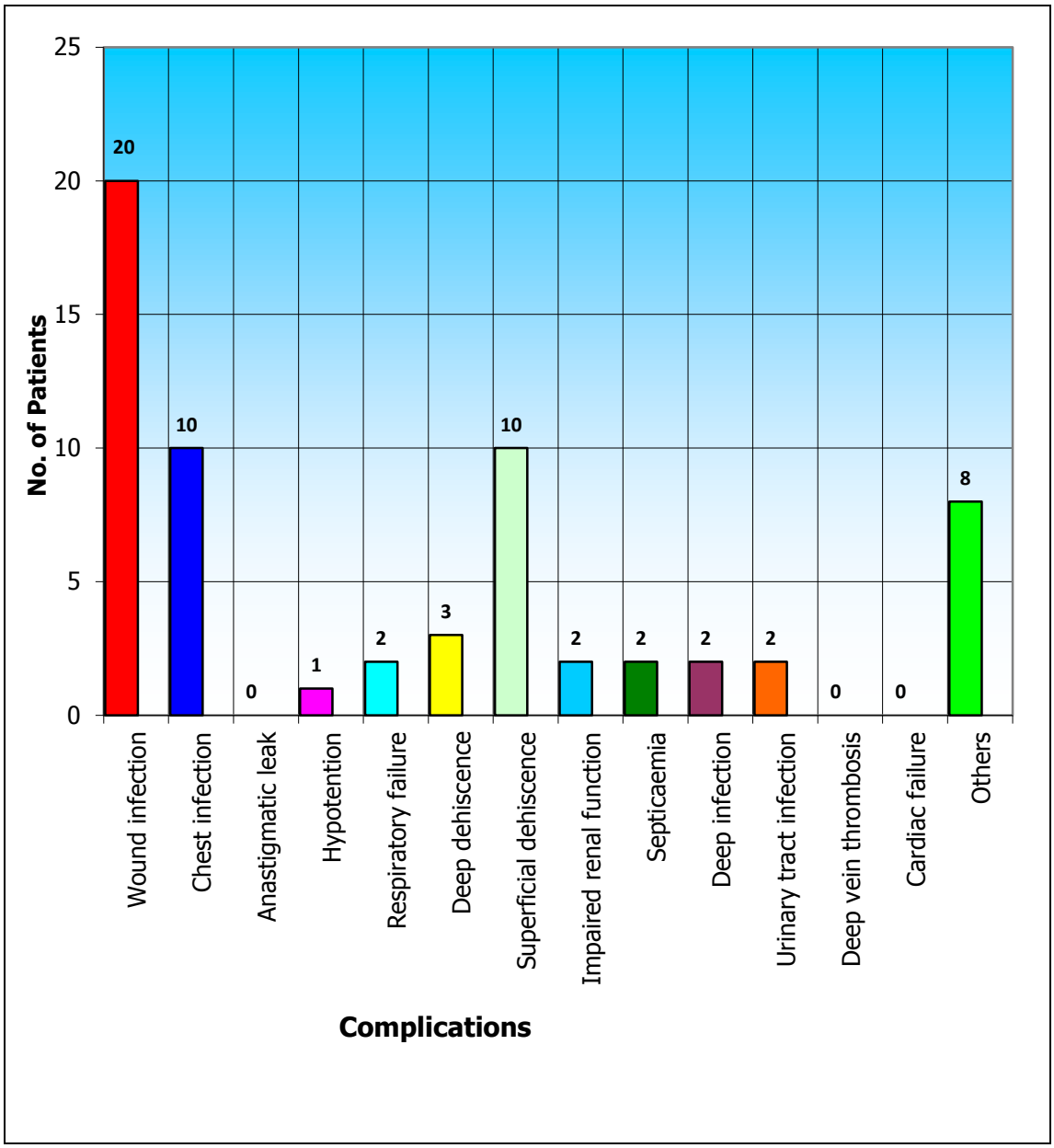
The complications occurring during the 30 day follow up period following the surgeries are listed in table 3.

Table 3. Complications

The post operative complications noted during the 30 days follow up period are listed

S.NO	Type	No. of cases
1.	Wound infection	20
2.	Chest infection	10
3.	Anastigmatic leak	0
4.	Hypotention	1
5.	Respiratory failure	2
6.	Deep dehiscence	3
7.	Superficial dehiscence	10
8.	Impaired renal function	2
9.	Septicaemia	2
10.	Deep infection	2
11.	Urinary tract infection	2
12.	Deep vein thrombosis	0
13.	Cardiac failure	0
14.	Others	8
Total		**62**

Graph 6.Complications



RISK FACTORS

The analysis of risk factors for low outcome in our study is represented in **Table 4a**

type * mortality Cross tabulation

	Value	df	Asymp. Sig. (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	0.048[a]	1	0.827		
Continuity Correction[b]	0.000	1	1.000		
Likelihood Ratio	0.048	1	0.827		
Fisher's Exact Test				1.000	0.500
Linear-by-Linear Association	0.048	1	0.827		
N of Valid Cases[b]	150				

a. 0 cells (.0%) have expected count less than 5. The minimum expected count is 12.50.

b. Computed only for a 2x2 table

Table 4b: observed and expected mortality tabulation

			Mortality		Total
			Yes	No	
Type	Observed	Count	12	63	75
		% within type	16.0%	84.0%	100.0%
		% within mortality	48.0%	50.4%	50.0%

	Expected	Count	13	62	75
		% within type	17.3%	82.7%	100.0%
		% within mortality	52.0%	49.6%	50.0%
Total		Count	25	125	150
		% within type	16.7%	83.3%	100.0%
		% within mortality	100.0%	100.0%	100.0%

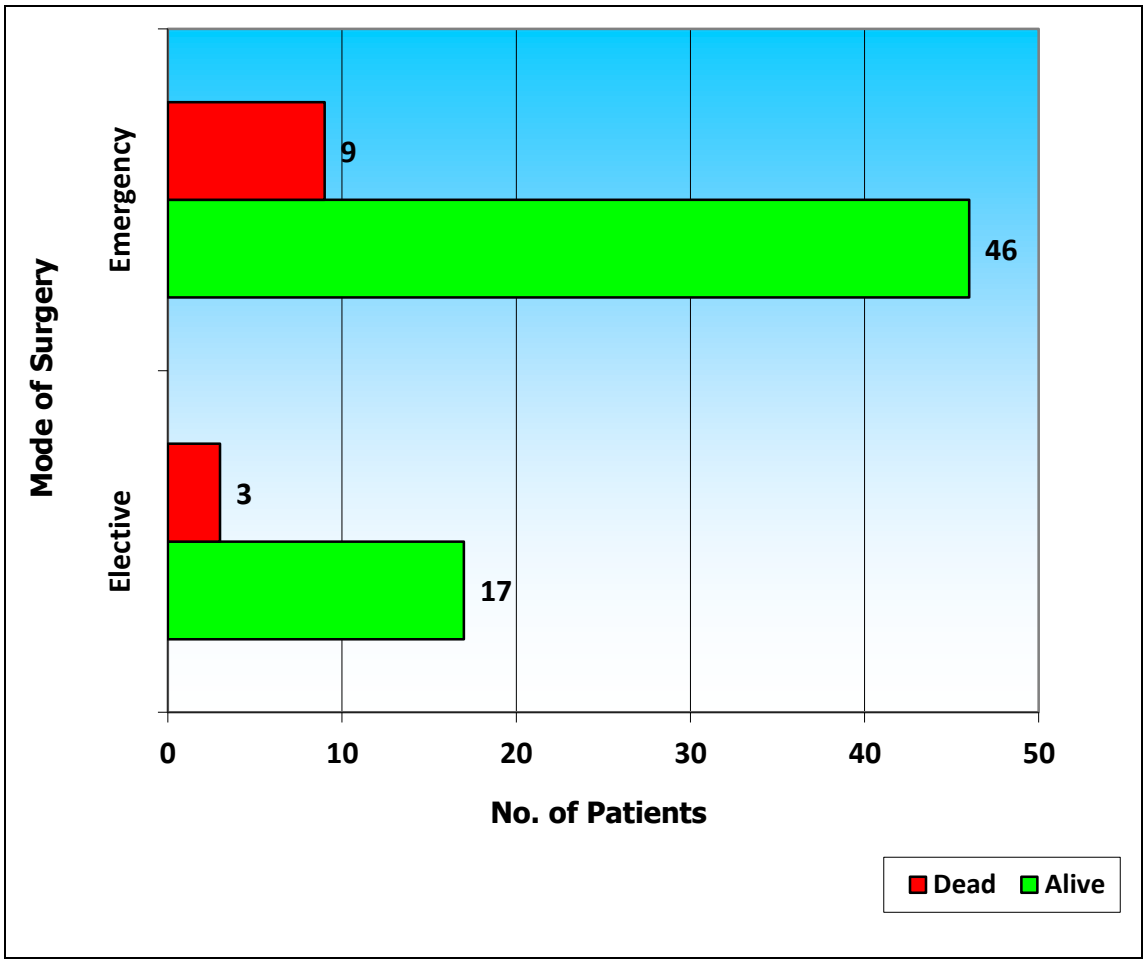
Mode of surgery:

There were 3 deaths (26.6%) among 20 elective cases (15%) and 9deaths (73.3%) from 55 emergency major surgeries(85%) in our study. A positive rate of increment of deaths per score was obtained.

Table :5

MODE OF SURGERY	**No of cases**	**No of cases dead**	**No of cases alive**
ELECTIVE	20	3	17
EMERGENCY	55	9	46

Graph : 7 Mode of Surgery



2. Malignancy:

There were 3 cases with malignancies on which surgery was done. They are with primary only, without lymph node involvement, accounting for1 deaths. A positive rate of increment of deaths per score was obtained suggesting association of malignancy with adverse outcome and statistically significant association was obtained.

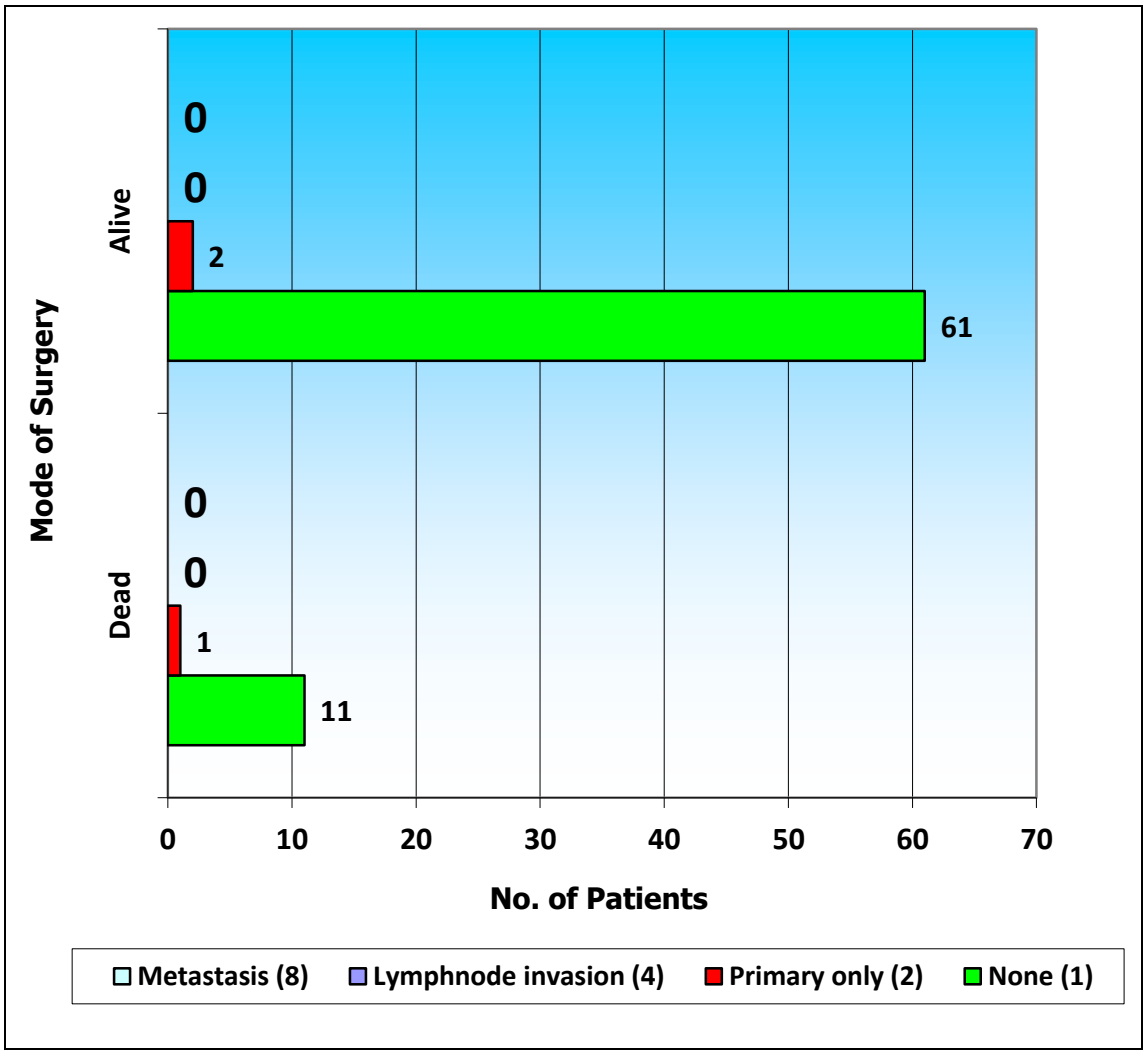
Table . 6 Malignancy

Malignancy	No. of cases	No. of cases dead	No. of cases Alive
None (1)	72	11	61
Primary only (2)	3	1	2
Lymphnode invasion (4)	0	0	0
Metastasis (8)	0	0	0

Table : 7 Malignancy

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	71	94.6	94.6	94.6
2	4	5.4	5.4	100.0
Total	75	100.0	100.0	

Graph 8. Malignancy



Electrocardiogram findings:

There were 30 cases with electrocardiographic abnormalities (scored 4 points) who were subjected to major general surgery and all 5 patients died. A positive rate of increment of deaths with score was obtained.

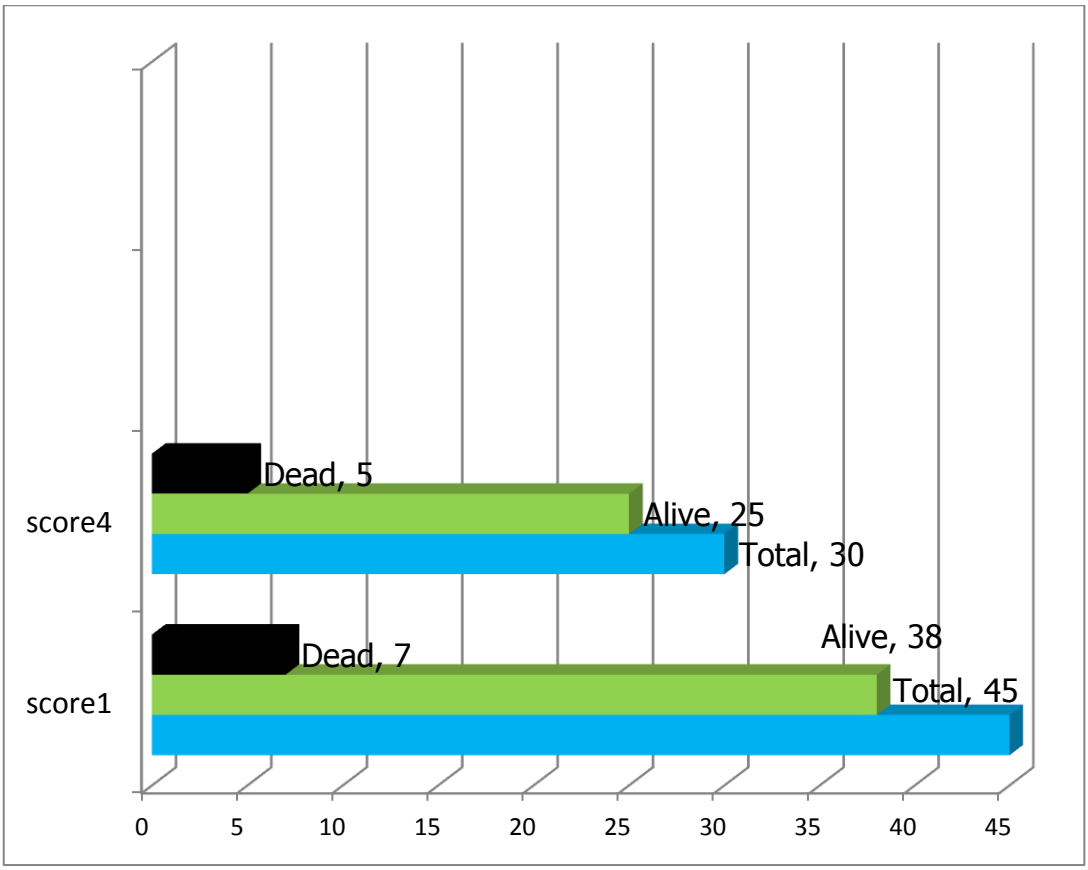
Table 8 . Electrocardiogram features

Electrocardiogram Features	No. of cases	No. of cases Dead	No. of cases Alive
Normal (1)	45	7	38
Atrial fibrillation(60-90)(4)	30	5	25
Any other abnormal rhythm or >5ectopics/min, Q waves or ST/T wave changes(8)	0	0	0

Table : 9 Electrocardiogram

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	45	59.5	59.5	59.5
4	30	40.5	40.5	100.0
Total	75	100.0	100.0	

Graph 9. Electrocardiogram



4. Peritoneal contamination:

In a total of 65 surgeries, some degree of peritoneal contamination was found and 10 surgeries (13 %) were associated with free bowel content, blood or gross pus. A positive rate of increment of deaths per score was obtained suggesting association of degree of peritoneal contamination with adverse outcome but was not found to be statistically significant.

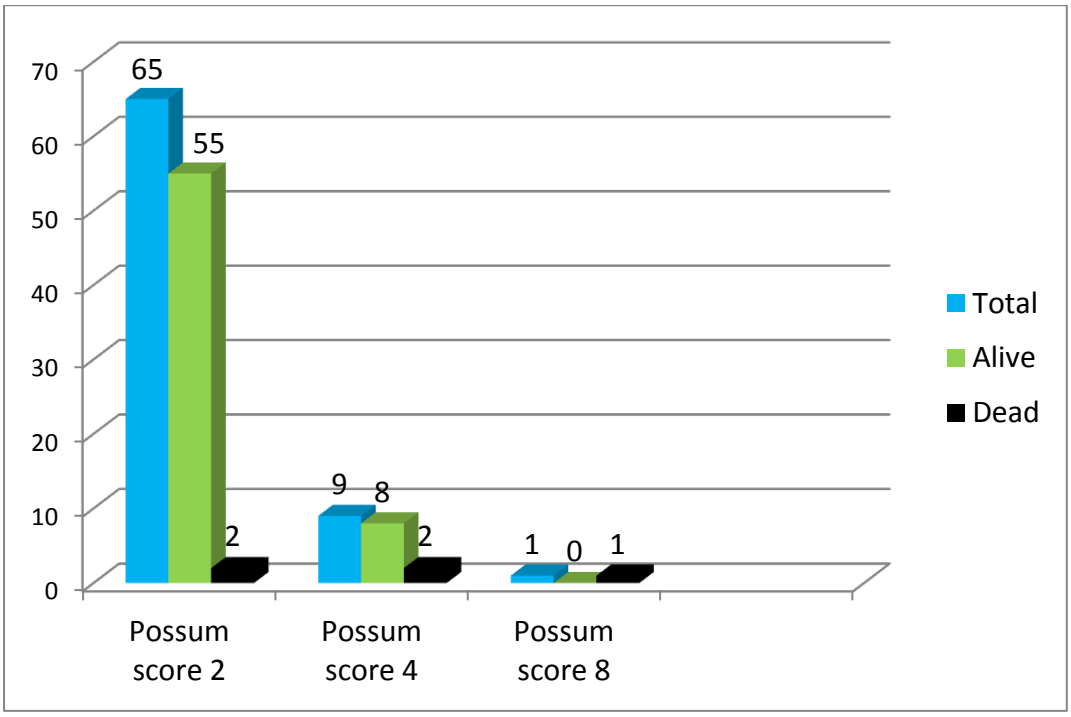
Table 10. Peritoneal contamination

Peritoneal contamination	No. of cases	No. of cases dead	No. of cases alive
None (1)	0		
Minor serous fluid (2)	65	10	55
Local pus(4)	9	1	8
Free bowel content, pus, blood (8)	1	1	0

Table : 11 Peritoneal contamination

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
2	65	86.5	86.5	86.5
4	9	12.2	12.2	98.6
8	1	1.4	1.4	100.0
Total	75	100.0	100.0	

Graph 10. Peritoneal contamination



5. Total blood loss:

In our study we found majority of cases resulted in 100-200 ml blood loss (61 cases, 81%), which also accounted for majority of mortalities (10 cases, 13%).There were 14 cases with 500-1000ml blood loss of which 2 case died during the study period. There were no cases with > 1000ml blood loss in our study. On analysis, a positive rate of increment with deaths in relation to increase in scores was found, suggesting correlation of higher blood loss with more adverse outcome and was found to be statistically significant.

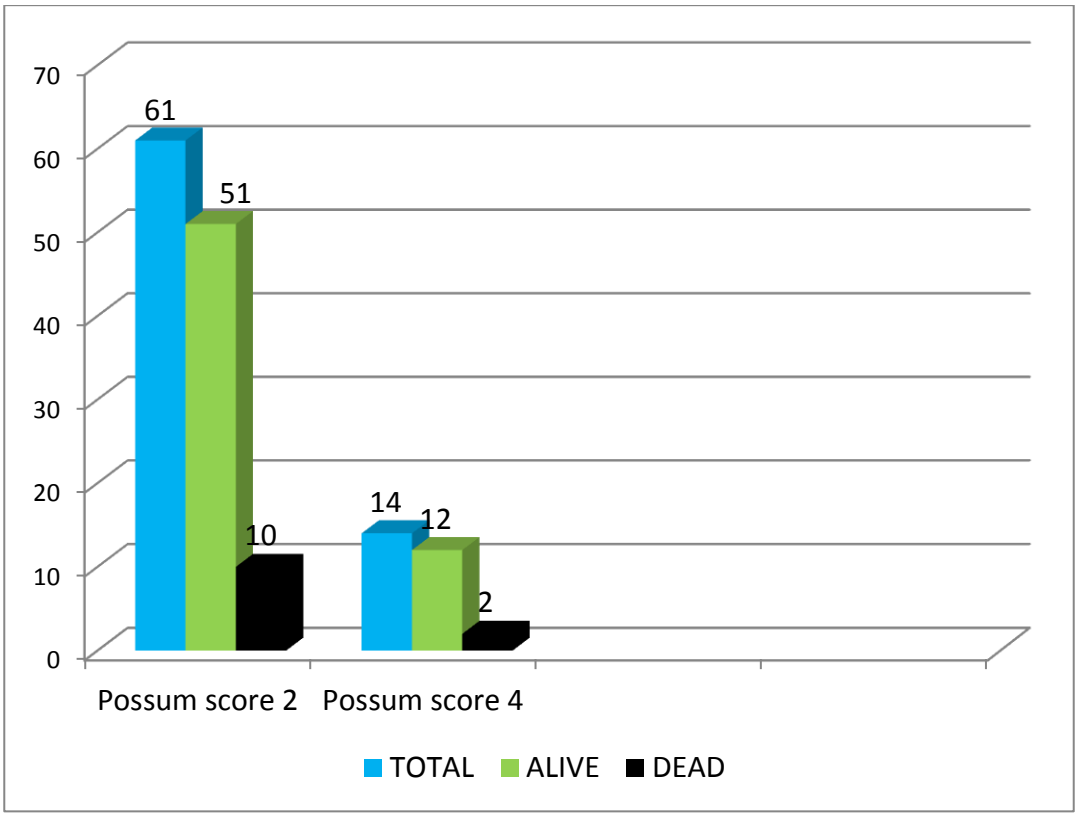
Table :12 Total blood loss

Total blood loss	No. of cases	No. of cases dead	No. of cases alive
<100 ml loss(1)	0	0	0
100-500 ml loss (2)	61	10	51
500-1000 ml loss (4)	14	2	12
>1000 ml loss (8)	0	0	0

Table : 13 Total blood loss

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
2	61	82.4	82.4	82.4
4	14	17.6	17.6	100.0
Total	75	100.0	100.0	

Graph 11. Total blood loss.



6. Serum potassium :

Our study group comprised of 75 surgeries performed on patients with some degree of imbalance in serum potassium concentration which accounted for 12 deaths (16%). On analysis a positive rate of increment per score was obtained suggesting correlation of deaths with scoring of imbalance in potassium concentration but was not statistically significant.

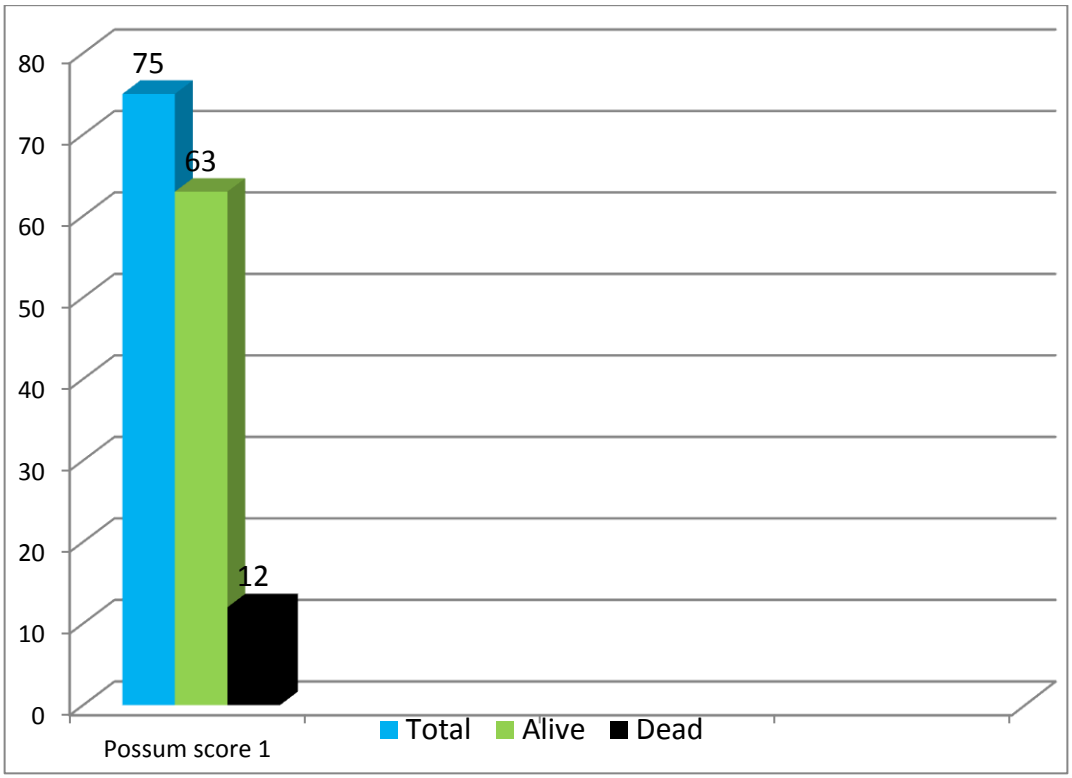
Table 14. Serum potassium

K+(mmol/l)	No. of cases	No. of cases dead	No. of cases alive
3.5-5 (mmol/l) (1)	75	12	63
3.2-3.4(mmol/l) 5.2-5.3(mmol/l) (2)	0	0	0
2.9-3.1(mmol/l) 5.4-5.9(mmol/l) (4)	0	0	0
<2.8(mmol/l) >6(mmol/l) (8)	0	0	0

Table : 15 Serum potassium

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	75	100.0	100.0	100.0

Graph 12. Serum potassium.



7. Serum sodium:

Surgeries done on cases with serum sodium abnormalities accounted for 75 cases with mortality occurring in 12 cases (16%). A positive rate of increment of deaths was found on analysis and was found to be statistically significant.

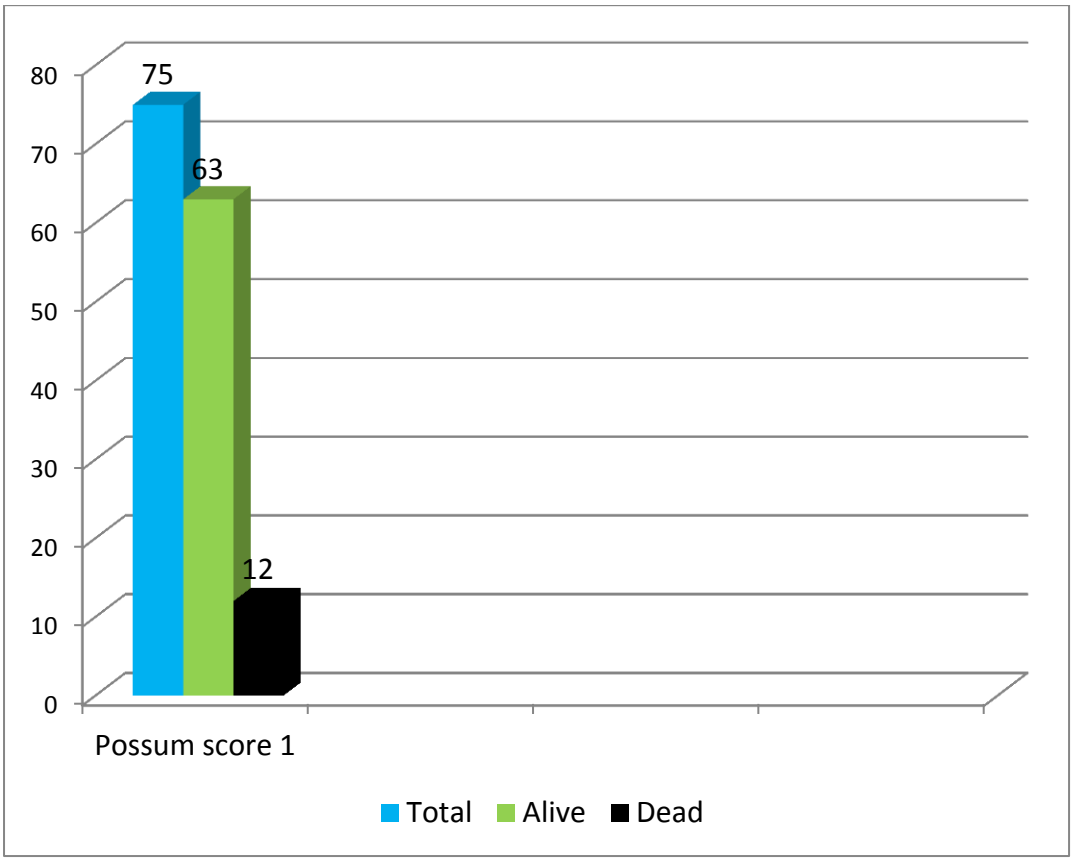
Table 16 Serum sodium

Sodium Na+ (mmol/l)	No. of cases	No. of cases dead	No. of cases alive
>136 (mmol/l) (1)	0	0	0
131-135 (mmol/l) (2)	75	12	63
126 -130 (mmol/l) (4)	0	0	0
<125 (mmol/l) (8)	0	0	0

Table : 17 Serum sodium

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
2	75	100.0	100.0	100.0

Graph 13. Serum sodium



8. Blood urea:

A total of 20 procedures (27%) were performed on patients with elevated blood urea levels and these cases accounted for 3 deaths (15%)q with the majority of deaths occurring in the highest score group A positive rate of increment of death with score was obtained and was found to be statistically significant.

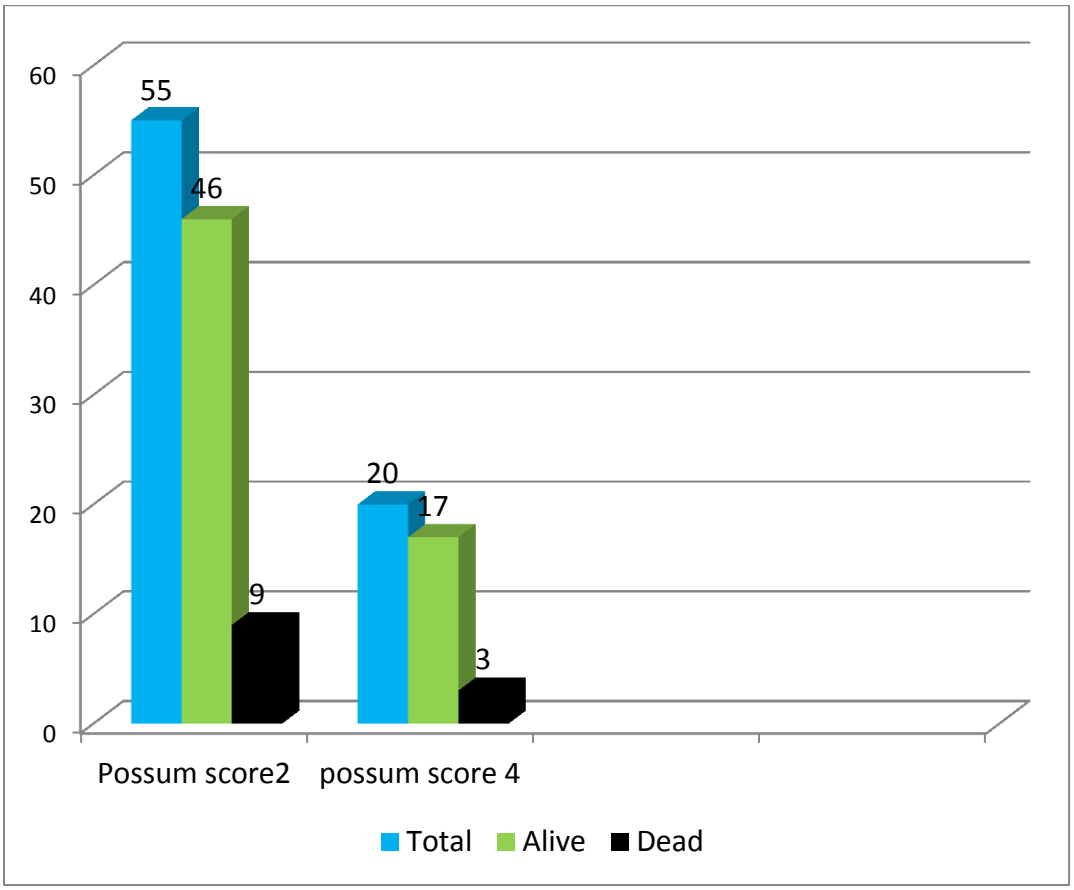
Table 18 . Blood urea

Blood urea (mmol/l)	No. of cases	No. of cases Dead	No. of cases Alive
<7.5(mmol/l) (1)	0	0	0
7.6 -10 (mmol/l) (2)	55	9	46
10.1-15(mmol/l) (4)	20	3	17
>15.1(mmol/l) (8)	0	0	0

Table : 19 Blood urea

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
2	55	73.0	73.0	73.0
4	20	27.0	27.0	100.0
Total	75	100.0	100.0	

Graph 14. Blood urea



9. White cell count:

Surgeries done on patients with leucocytosis accounted for 75 cases 12 deaths (16%) occurring in this group. A positive rate of increment of deaths with higher score was obtained and was not found to be statistically significant.

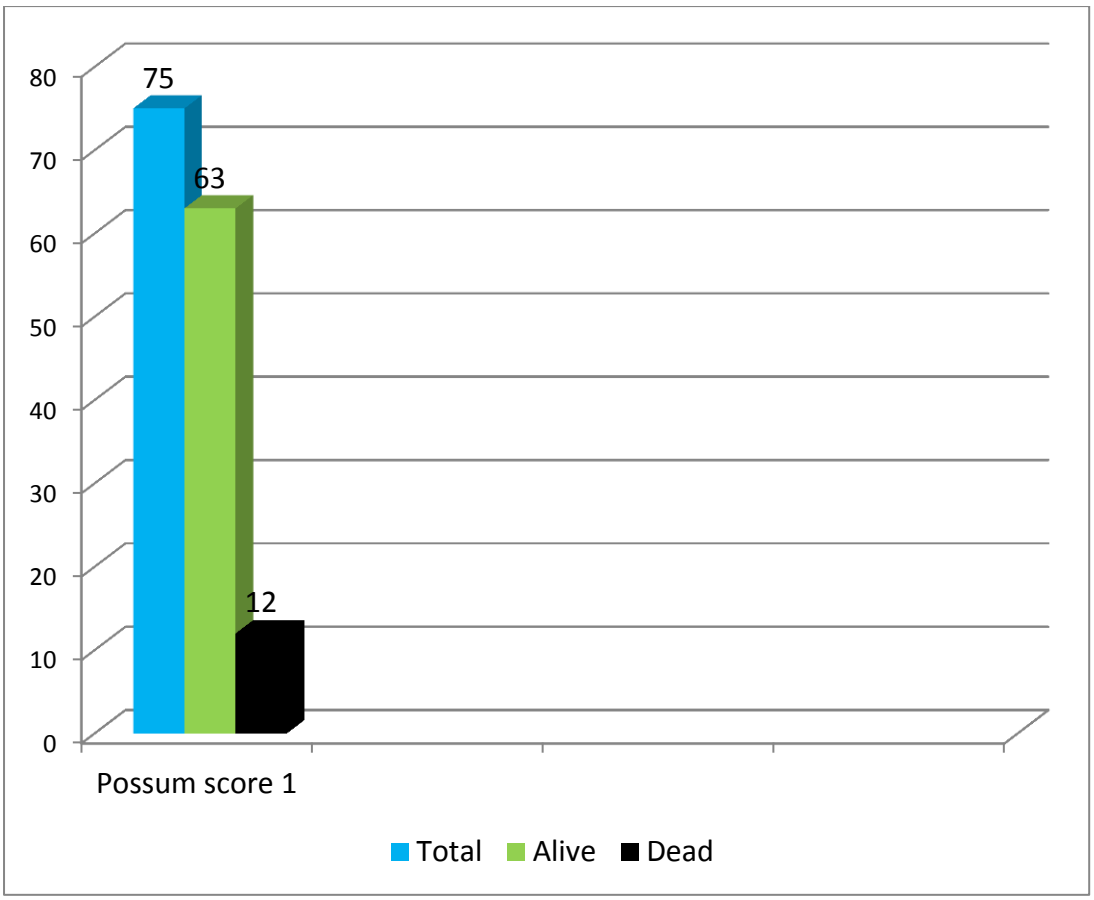
Table 20 White cell count

White cell count (x10 12/l	No. of cases	No. of cases dead	No. of cases alive
4-10 (1)	75	12	63
10.1-20 3.1-4 (2)	0		
>20.1 <3.1 (4)	0		

Table ; 21 White cell count

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	75	100.0	100.0	100.0

Graph 15. White cell count



10. Haemoglobin:

A majority of the procedures were done on patients with abnormalities in hemoglobin levels75 cases and these cases accounted for 12 deaths (16%). A positive rate of increment of deaths with adverse score was obtained but was not found to be statistically significant.

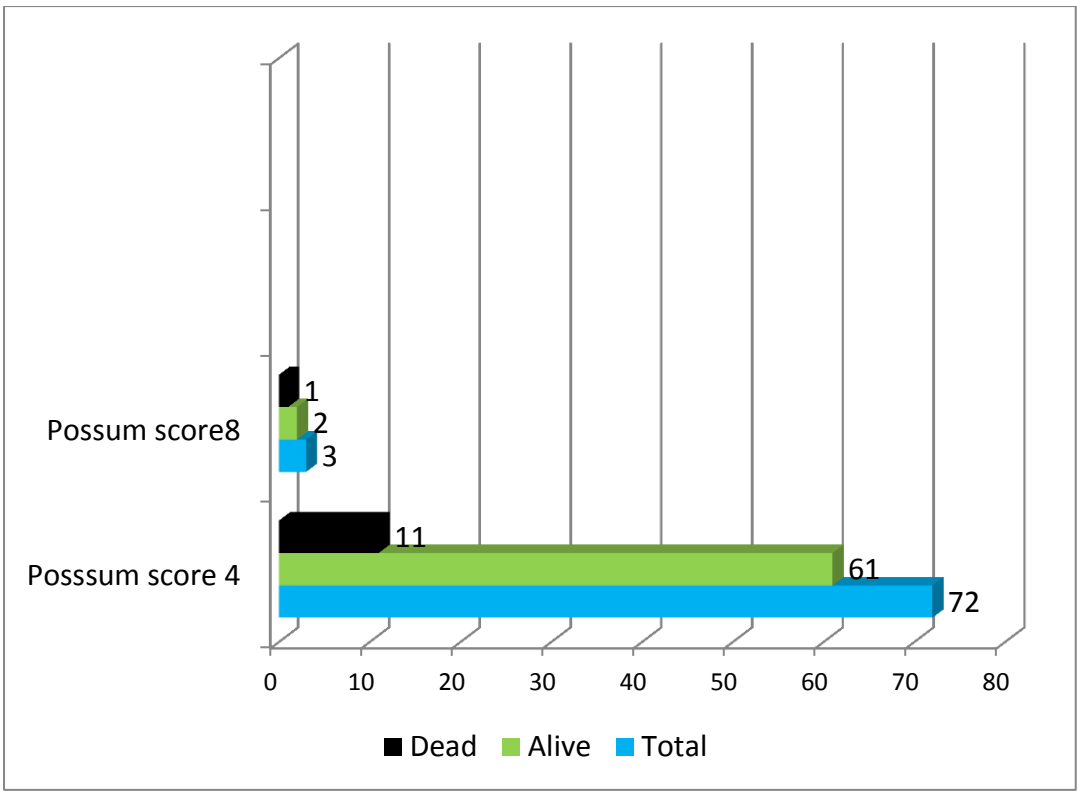
Table 22 Haemoglobin

Haemoglobin (g/dl)	No. of cases	No. of cases dead	No. of cases alive
13-16 (g/dl) (1)	0		
11.5-12.9(g/dl) 16.1-17(g/dl) (2)	0		
10-11.4 (g/dl) 17.1-18 (g/dl) (4)	72	11	61
<9.9(g/dl) >18.1(g/dl) (8)	3	1	2

Table : 23 Haemoglobin

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
4	72	95.9	95.9	95.9
8	3	4.1	4.1	100.0
Total	75	100.0	100.0	

Graph 16. Haemoglobin



11. Glasgow coma scale:

There were 30 cases (40%) with low Glasgow coma scale score who were subjected to surgery and accounted for 5 deaths (16.7%).There were no patients with score less than 9 in our study. A positive rate of increment of deaths with higher POSSUM score was obtained but was t found to be statistically significant.

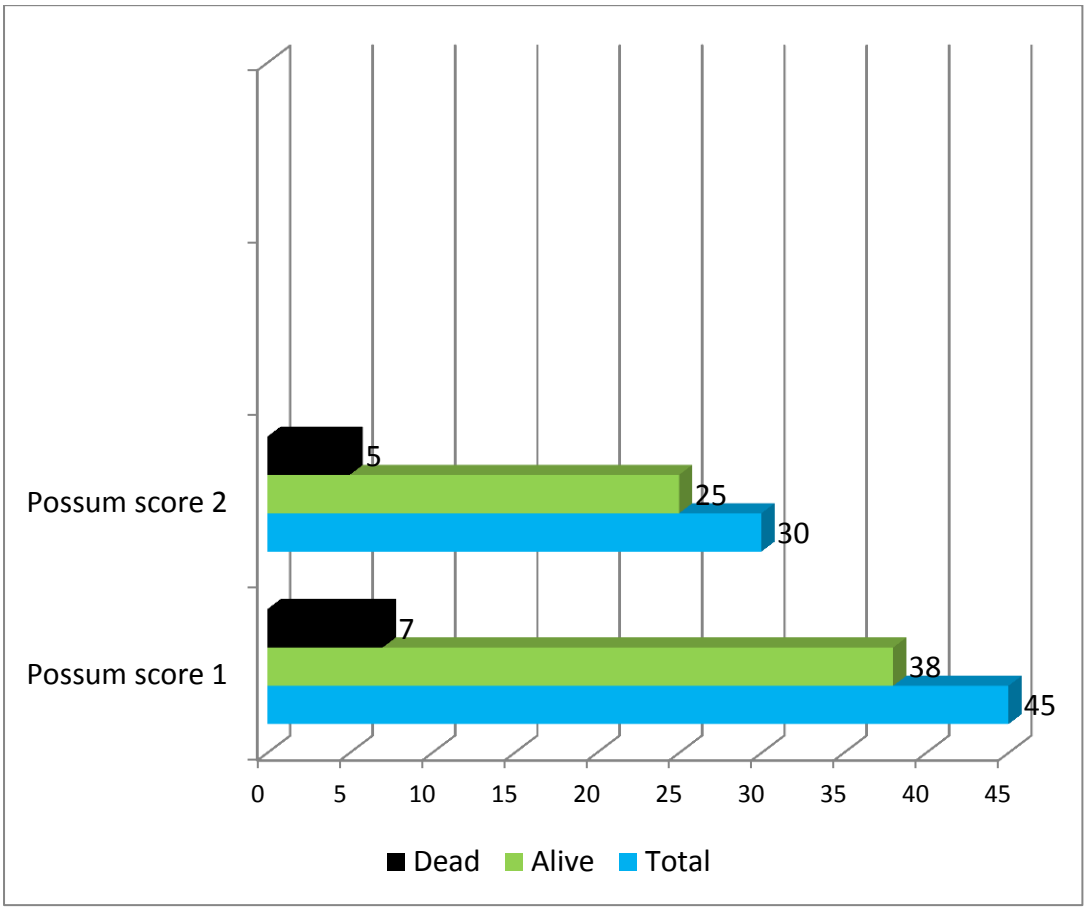
Table 24. Glasgow coma scale

Glasgow coma scale	No. of cases	No. of cases dead	No. of cases alive
15 (1)	45	7	38
12-14 (2)	30	5	25
9-11 (4)	0	0	
<8 (8)	0	0	

Table : 25 Glasgow coma scale

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	45	59.5	59.5	59.5
2	30	40.5	40.5	100.0
Total	75	100.0	100.0	

Graph 17. Glasgow coma scale



12. Pulse rate:

A total of 5 surgeries (6.6%) were done on patients with higher POSSUM scores for pulse rate and accounted for one deaths (20%). A positive rate of increment of deaths with higher POSSUM scores was found in our study but was found to be statistically significant.

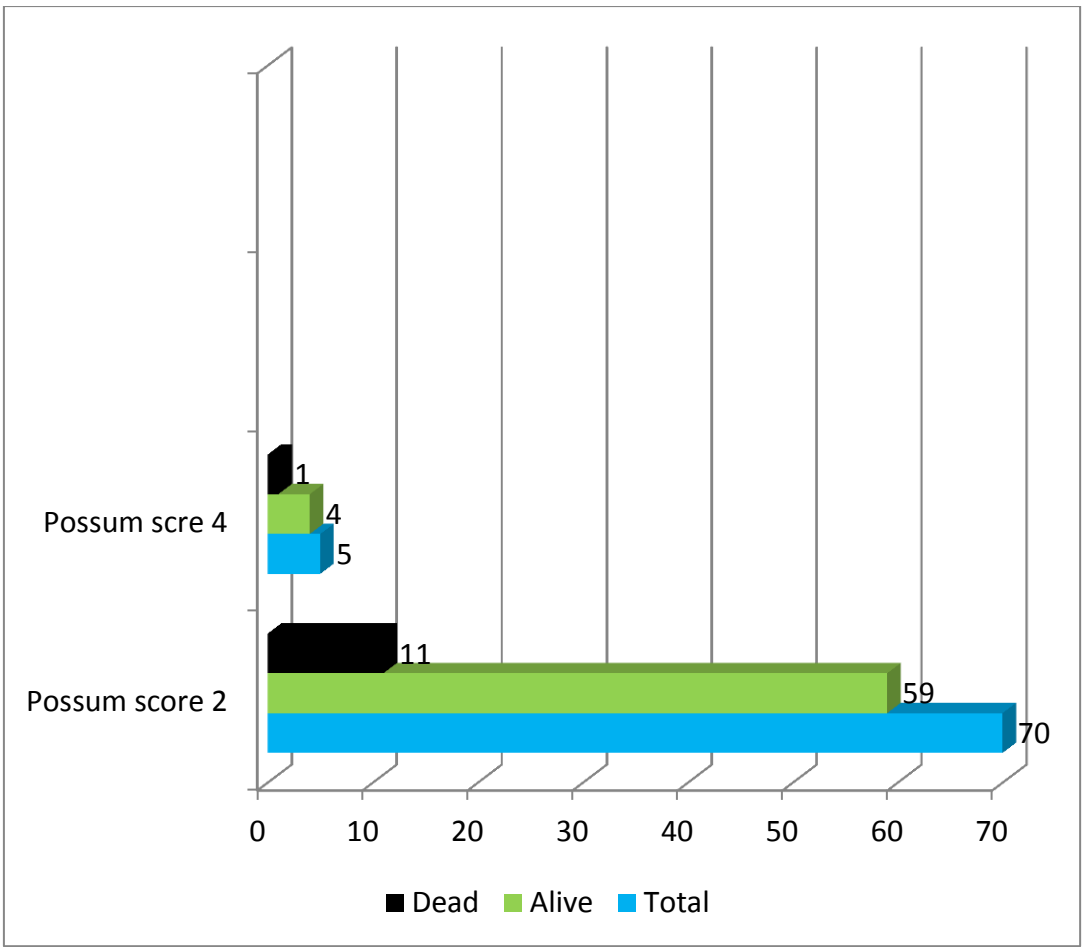
Table 26. Pulse rate

Pulse (beats/min)	No.of cases	No.of cases Dead	No. of cases Alive
50-80 (beats/min) (1)	0		
81-100 40-49 (beats/min) (2)	70	11	59
101-120 (beats/min) (4)	5	1	4
>121 <39 (beats/min) (8)	0		

Table : 27 Pulse rate

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
2	70	93.2	93.2	93.2
4	5	6.8	6.8	100.0
Total	75	100.0	100.0	

Graph 18. Pulse rate



13. Blood pressure:

A total of one procedures (1.3%) were done on patients with higher POSSUMscore for blood pressure and these cases accounted for one deaths (100%). A positive rate of increment of deaths with higher POSSUM scores was found in our study group was to be statistically significant.

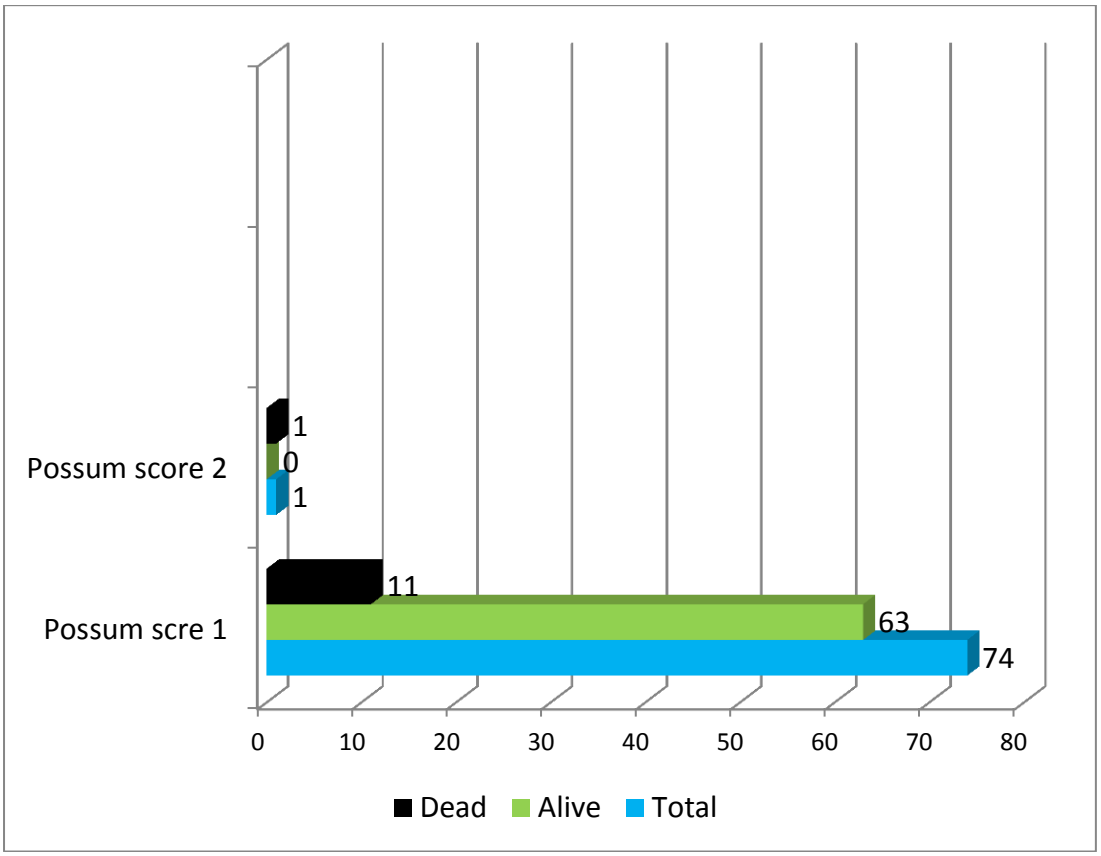
Table 28 . Blood pressure

Blood pressure (systolic)(mm of Hg)	No. of cases	No. of cases Dead	No. of cases Alive
110-130 (mm of Hg) (1)	74	11	63
131-170 100-109 (mm of Hg) (2)	1	1	0
>171 90-99 (mm of Hg) (4)	0		
<89 (mm of Hg) (8)	0		

Table : 29 Blood pressure

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	74	98.6	98.6	98.6
2	1	1.4	1.4	100.0
Total	75	100.0	100.0	

Graph 19. Blood pressure



14. **Respiratory system**:

A total of 30 surgeries (40%) were performed on patients with higher POSSUM scores and these procedures resulted in 5 deaths (16.7%).A positive rate of increment of deaths with higher POSSUM scores for respiratory system was found but was not found to be statistically significant.

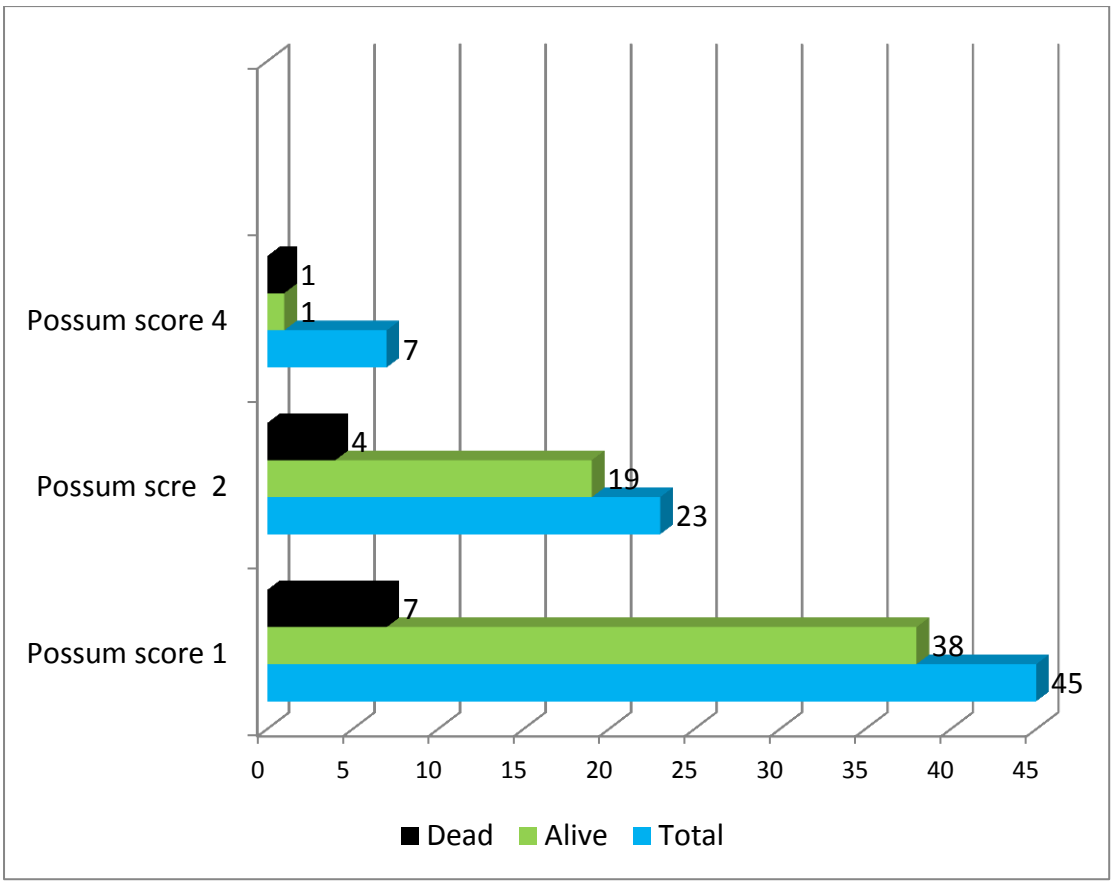
Table 30 Respiratory system

Respiratory system	No. of cases	No. of cases Dead	No. of cases Alive
No dyspnoea (1)	45	7	38
Dyspnoea on exertion , Mild COAD (2)	23	4	19
Limiting dyspnoea,moderate COAD (4)	7	1	6
Dyspnoea at rest (rate>30/mt),Fibrosis or consolidation (8)	0		

Table : 31 Respiratory system

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	45	59.5	59.5	59.5
2	23	31.1	31.1	90.5
4	7	9.5	9.5	100.0
Total	75	100.0	100.0	

Graph 20. Respiratory system



15. Cardiovascular system:

There were only20 surgeries (27 %) performed on patients with higher POSSUM scores and resulted in 3 deaths (15 %). A positive rate of increment of deaths per score was found in our study but was not found to be statistically significant.

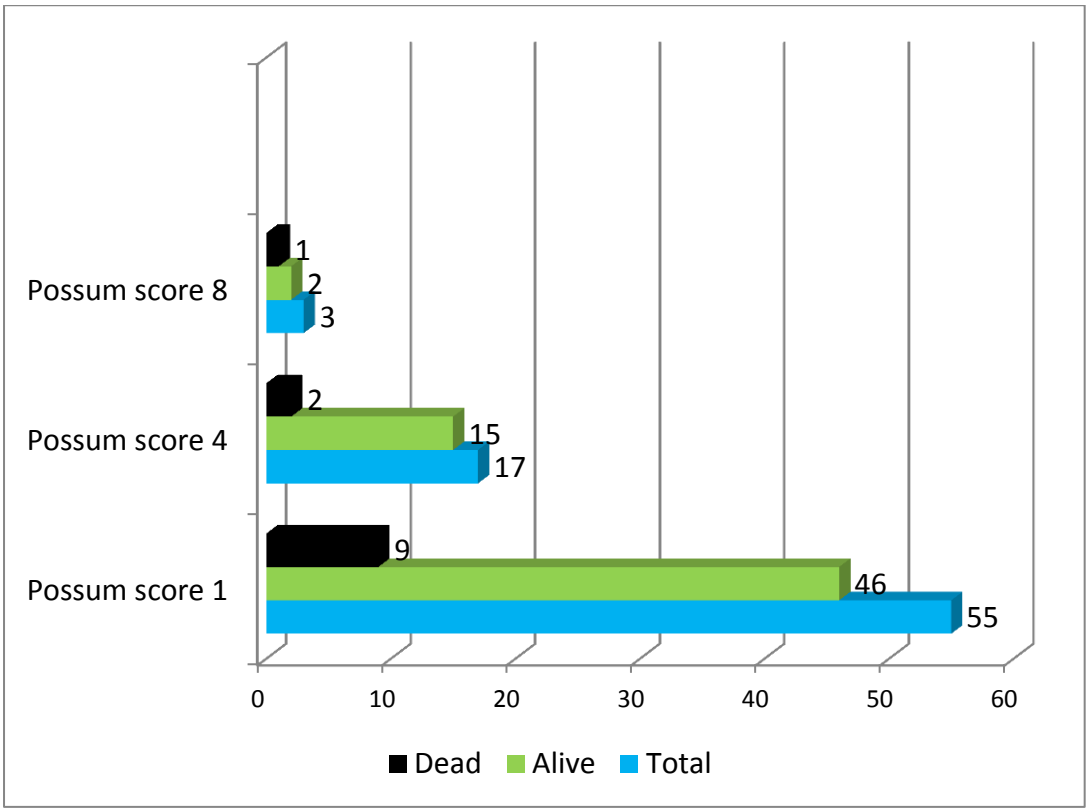
Table 32 . Cardiovascular system

Cadiac signs	No. of cases	No. of cases Dead	No. of cases Alive
No failure (1)	55	9	46
Diuretic, Digoxin, Anti angina or Anti hypertensive therapy (2)	0	0	0
Peripheral edema, Warfarin therapy, Borderline	17	2	15
Raised JVP, cardiomegaly (8)	3	1	2

Table : 33 Cardiovascular system

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	55	73.0	73.0	73.0
4	17	23.0	23.0	95.9
8	3	4.1	4.1	100.0
Total	75	100.0	100.0	

Graph 21. Cardiovascular system



16. Age:

A total of 10 surgeries (13.3%) were performed on patients with age more than 60years and these cases accounted for 2 deaths (20%). A positive rate of increment was found between deaths and higher POSSUM scores for age of the patient.

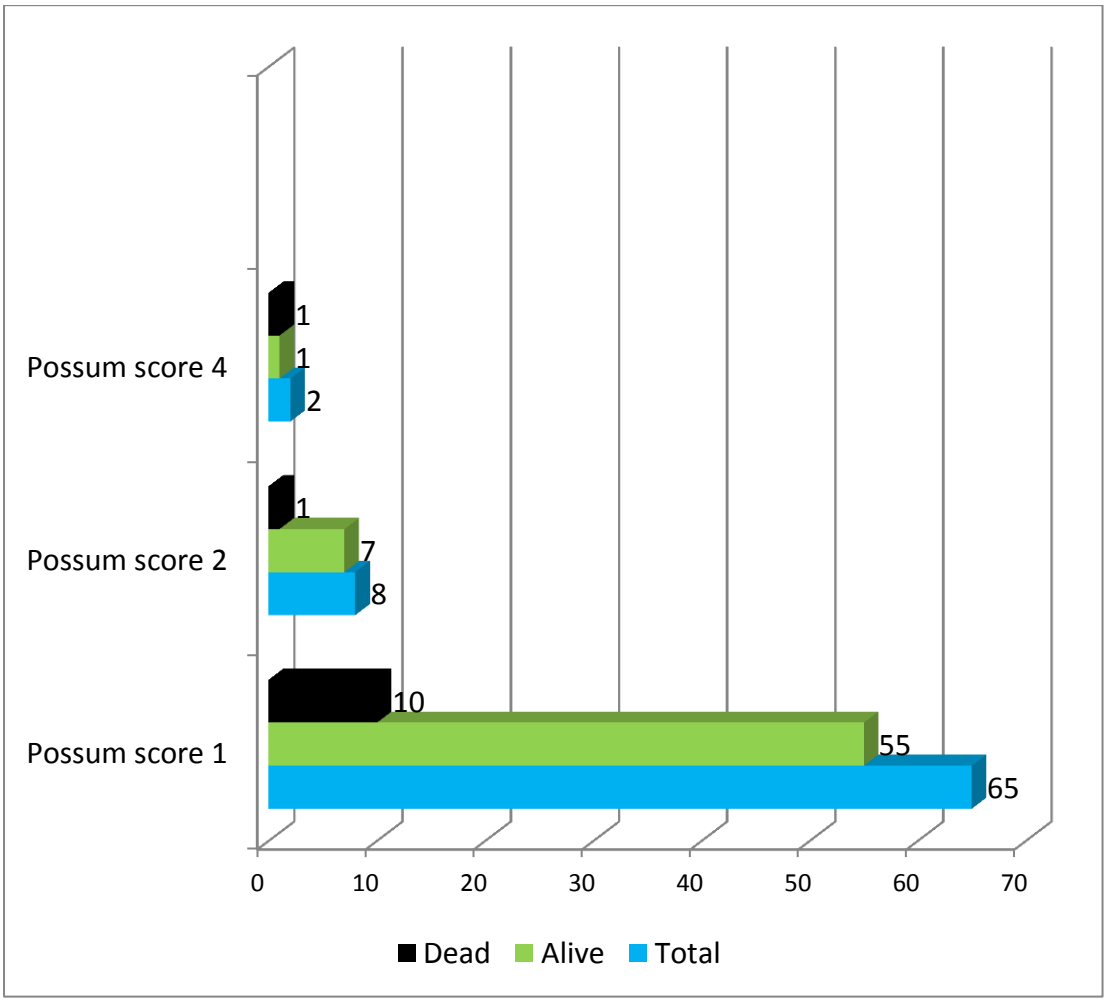
Table 34 . Age

Age	No. of cases	No. of cases Dead	No. of cases Alive
<60 yrs (1)	65	10	55
61-70 yrs(2)	8	1	7
>71 yrs(4)	2	1	1

Table : 35 Age

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	65	86.5	86.5	86.5
2	8	10.8	10.8	97.3
4	2	2.7	2.7	100.0
Total	75	100.0	100.0	

Graph 22. Age



17. **Multiple surgeries**:

There were 30 multiple surgeries (2 surgeries) performed in our study which accounted for 4 deaths. A positive increment of deaths with higher POSSUM score was found.

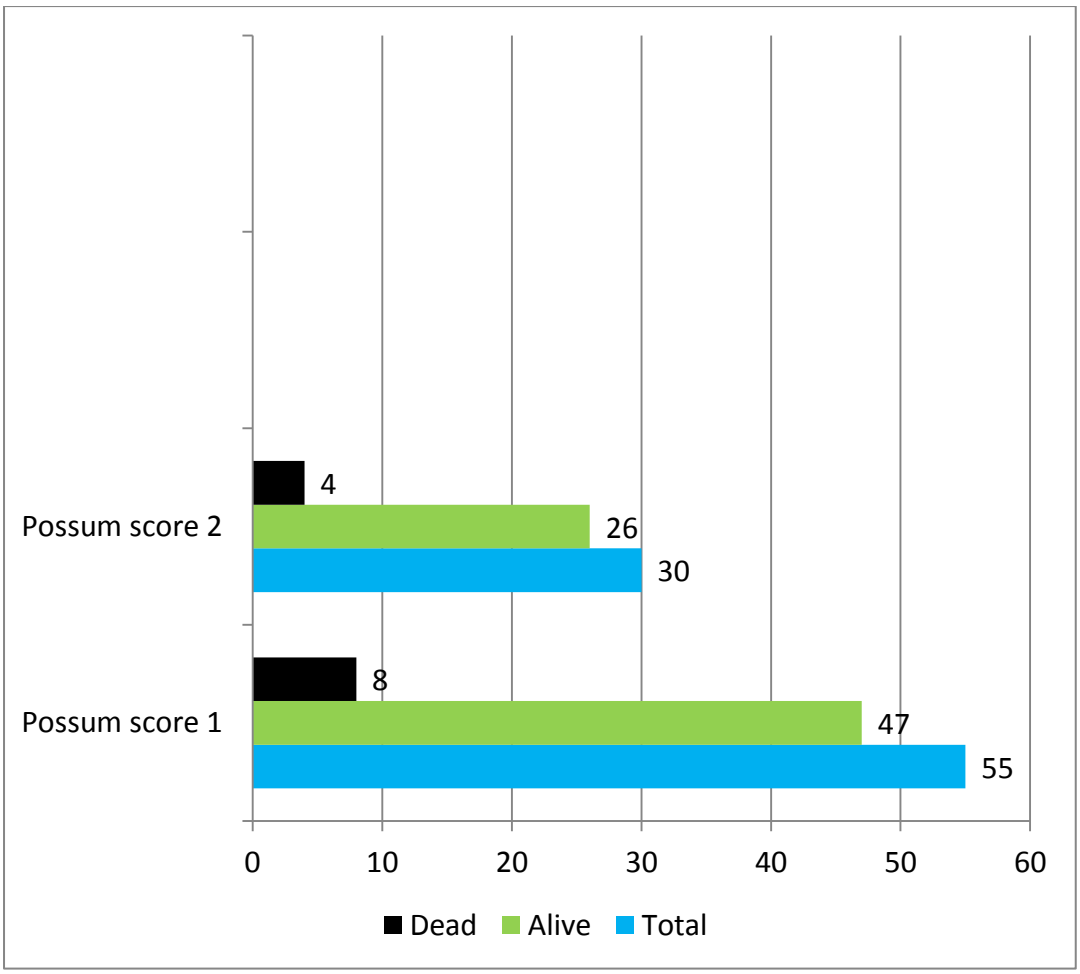
Table 36 . Multiple surgeries

No of procedures	No. of cases	No. of cases Dead	No. of cases Alive
Single procedure(1)	45	8	37
Multiple procedure (4)	30	4	26

Table : 37 Multiple surgeries

Score	Frequency (cases)	Percent	Valid Percent	Cumulative Percent
1	45	59.5	59.5	59.5
4	30	40.5	40.5	100.0
Total	75	100.0	100.0	

Graph 23. Multiple surgeries



Discussion

The basic tenet in medical care has been to provide quality care to the patient to cause reduction in adverse outcome. It is by comparing the adverse outcome rates that we can assess the adequacy of care provided to the patient and evolve new treatment strategies. However, comparison using crude mortality rates can be misleading as it cannot adequately account for the patient's general condition and the disease process for which he was subjected to surgery. To overcome this shortcoming POSSUM, a risk adjusted scoring system was proposed. In our study we assessed the validity of P-POSSUM in 75 major general surgeries by comparing the observed mortality rate with expected mortality rate. 12 patients died (mortality rates of1 5% (elective) and16% (emergency), the total crude mortality rate being 16%). However on using P-POSSUM the expected mortality rate was12 deaths. On analysis, there was found to be no statistically significant difference between the observed and expected mortality rates (P Value = 0.048).

An O: E ratio of 0.96 was obtained. Similar findings were obtained by Yii MK and Ng KJ19 (O: E = 1.28), Tekkis15 (O: E =

0.98)and Mohil 20(O: E = 0.66, $x2$ = 5.33, 9 d.f., p =0.619). Hence P-POSSUM was able to accurately predict the adverse outcome following major surgery in our study. On analysing the risk factors we found positive rate of increment with all the risk factors studied but it was not found to be statistically significant with respect to malignancy , total blood loss , serum sodium , blood urea and white cell count. Various factors like decreased immunity and cachexia resulting from malignancy, ischemia and impaired haemostasis resulting from blood loss, uraemia resulting in decreased healing rates, impaired immunity, leucocytosis correlating with the degree of inflammation, toxaemia, hyponatremia resulting into impaired physiological response could be attributed to the effect of these factors on post operative mortality rate.

Therefore adequate and prompt correction can definitely be expected to cause a decrease inadverse outcome rates. Tekkis and others found that total blood loss was not significant enough to alter their statistical analysis in their study but their study predominantly involved elective cases (26.6%) . Wound infection (20 cases, 26%) and chest infections (10 cases,13%) accounted for the majority of complications. Similar results were obtained by Mohil RS (35% and 20% respectively)20.Wound infections could be attributed to the large number

of patients who had gross peritoneal contamination resulting from hollow visceral perforation resulting in local contamination of the incision site. A raised diaphragm, upper abdominal incision and gross peritoneal contamination resulting into higher rates of chest infections in our group.

Conclusion

We studied 75 major general surgeries, both elective (26.6%) and emergency cases (73.3%), which resulted in 12 deaths (16% mortality rate). On applying P-POSSUM we found that the expected number of deaths for our study group was 13 (O: E = 0.96).We found no difference between expected and observed mortality rates.

The present study suggests that P-POSSUM is an accurate scoring system for predicting post operative adverse outcome among patients undergoing major general surgeries. The complications of wound infection (26%) and chest infection (13%) are a concern and require better care for their prevention following major general surgeries. All the studied risk factors were found to have a positive rate of increment of deaths with higher scores. Presence of malignancy, total blood loss, serum sodium levels and blood urea levels and leukocytosis were found to be significant in our study. Hence adequate and prompt correction of these factors could decrease the mortality rate.

This study therefore validates P-POSSUM as a valid means of assessing adequacy of care provided to the patient. P-POSSUM can be used for surgical audit to assess and improve the quality of surgical care and result in better outcome to the patient.

Summary

A total of 75 major surgical operations were studied in patients admitted in general surgery department in government Rajaji hospital ,Madurai medical college,Madurai. The study group consisted of 20 elective and 55 emergency cases. Duodenal perforation (30 cases), malignancy (3 cases), intestinal obstruction (9 cases), Ileal perforation (8 cases), gastric perforation (7 cases), appendicular perforations (5cases), limb gangrene (4 cases), obstructed hernia (3 cases), others(3 cases) were the indications for which the patients were subjected for surgery. Laparotomies accounted for 58 cases, resection anastomosis for 10 cases, amputations for 4 cases and cholecystectomy accounted for 3case. They were scored using P-POSSUM scoring system, physiological scoring was done at the time of admission and operative scoring was done intraoperatively. They were followed up for the first 30 day post operative period for any complications and the outcome was noted. The observed mortality rate was compared with the P- POSSUM expected mortality rate.12 patients died (mortality rates of 15% (elective) and 16% (emergency), the total mortality rate of 16%) The P-POSSUM expected

mortality rate was 13 deaths. An O: E ratio of 0.96 was obtained. There was no statistical difference between the observed and P-POSSUM predicted mortality rates (p = 0.048). On analyzing the risk factors we found positive rate of increment with all the risk factors studied but it was not found to be statistically significant with respect to malignancy , total blood loss ,sodium, blood urea , and white cell count ,Wound infection (20 cases, 26%) and chest infections (10 cases, 13%) accounted for the majority of complications.

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APPENDIX I

PROFORMA

1. NAME	:	I.P.No	:
2. AGE	:	UNIT	:
3. SEX	:	D.O.A.	:
4. RELIGION	:	D.O.O.	:
5. OCCUPATION	:	D.O.D.	:
6. RESIDENCE	:		

PHYSIOLOGICAL SCORING:

1. AGE
2. CARDIAC SIGNS
   Chest Radiograph
3. RESPIRATORY HISTORY
   Chest Radiograph
4. BLOOD PRESSURE (systolic)
5. PULSE
6. GLASGOW COMA SCALE
7. HEMOGLOBIN(g/100 ml)
8. WHITE BLOOD CELL COUNT
   (x 1012 /L)
9. UREA (mmol/L)
10. SODIUM (mmol/L)
11. POTASSIUM (mmol/L)
12. ELECTROCARDIOGRAM

OPERATIVE SEVERITY SCORE:

1. OPERATIVE SEVERITY
2. MULTIPLE PROCEDURES
3. TOTAL BLOOD LOSS
4. PERITONEL SOILING
5. PRESENCE OF MALIGNANCY
6. MODE OF SURGERY

MORTALITY

P-POSSUM (Predicted) :

Actual : **(Yes/No)**

COMPLICATIONS RECORD SHEET

NAME :

I.P.No :

DIAGNOSIS :

OPERATION:

OUTCOME :

Haemorrhage

Wound

Deep

Other

Infection

Chest

Wound

Urinary tract

Deep

Septicaemia

Pyrexia

Other

Wound dehiscence

Superficial

Deep

Anastomotic leak

Thrombosis

Deep vein thrombosis

Pulmonary embolus

Other

Cerebrovascular accident

Myocardial infarct

Cardiac failure

Impaired renal function

(Urea increase > 5mmol/l,from preoperative level)

Hypotension (< 90mmHg for 2h)

Respiratory failure

Any other complication

Master Chart

S. No	Name	Sex	IP. No	Age	CVS	RS	BP	PR	GCS	HB	WBC	K+	NA +	ECG	Urea
1	DEVADAS	M	70232	1	1	1	1	2	1	4	1	1	2	1	2
2	ANDY	M	70237	1	1	1	1	2	1	4	1	1	2	1	2
3	SHANTHAKUMAR	M	72233	1	1	1	1	2	1	4	1	1	2	1	2
4	MUNIYANDI	M	72317	1	1	1	1	2	1	4	1	1	2	1	2
5	PANDIYARAJAN	M	72324	1	1	1	1	2	1	4	1	1	2	1	2
6	KARUPASAMY	M	74243	1	1	1	1	2	1	4	1	1	2	1	2
7	PALANI	M	774260	1	1	1	1	2	1	4	1	1	2	1	2
8	PANDESWARAN	M	74301	1	1	1	1	2	1	4	1	1	2	1	2
9	RAJENDRAN	M	76296	1	1	1	1	2	1	4	1	1	2	1	2
10	MURUGAN	M	76301	1	1	1	1	2	1	4	1	1	2	1	2
11	SUNDAR	M	67392	1	1	1	1	2	1	4	1	1	2	1	2
12	GOPAL	M	81396	1	1	1	1	2	1	4	1	1	2	1	2
13	MURUGAN	M	83584	1	1	1	1	2	1	4	1	1	2	1	2

14	SELVI	F	84500	1	1	1	1	2	1	4	1	1	2	1	2
15	VANI	F	84516	1	1	1	1	2	1	4	1	1	2	1	2
16	VANI	F	84516	1	1	1	1	2	1	4	1	1	2	1	2
17	THAVAMANI	F	83807	1	1	1	1	2	1	4	1	1	2	1	2
18	BALU	M	86961	1	1	1	1	2	1	4	1	1	2	1	2
19	ALAGURAJA	M	89190	1	1	1	1	2	1	4	1	1	2	1	2
20	RAKUL	M	224	1	1	1	1	2	1	4	1	1	2	1	2
21	KALIYAMMAL	F	301	1	1	1	1	2	1	4	1	1	2	1	2
22	MURUGESWARI	F	392	1	1	1	1	2	1	4	1	1	2	1	2
24	PALANISAMY	M	402	1	1	1	1	2	1	4	1	1	2	1	2
25	RAMAYEE	F	428	1	1	1	1	2	1	4	1	1	2	1	2
26	ROSIYAMMAL	F	431	1	1	1	1	2	1	4	1	1	2	1	2
27	RAMU	M	445	1	1	1	1	2	1	4	1	1	2	1	2
28	VIJAYAKUMAR	M	461	1	1	1	1	2	1	4	1	1	2	1	2
29	ARUMUGAM	M	476	1	1	1	1	2	1	4	1	1	2	1	2
30	PAPAPUCHETTY	M	479	1	1	1	1	2	1	4	1	1	2	1	2

31	MANIKANDAN	M	483	1	1	1	1	2	1	4	1	1	2	1	2
32	YAMINI	F	496	1	1	1	1	2	1	4	1	1	2	1	2
33	NAGAVALLI	F	500	1	1	1	1	2	1	4	1	1	2	1	2
34	PRABAKARAN	M	176I	1	1	1	1	2	1	4	1	1	2	1	2
35	BASKARAN	M	1765	1	1	1	1	2	1	4	1	1	2	1	2
36	DINISH	M	2392	1	1	1	1	2	1	4	1	1	2	1	2
37	KARUPASAMY	M	4068	1	1	1	1	2	1	4	1	1	2	1	2
38	MAHESWARI	F	4076	1	1	1	1	2	1	4	1	1	2	1	2
39	MARIYAMMAL	F	4086	1	1	1	1	2	1	4	1	1	2	1	2
40	PONDY	M	4151	1	1	1	1	2	1	4	1	1	2	1	2
41	MUTHUKARRUPU	M	5913	1	1	1	1	2	1	4	1	1	2	1	2
42	ALAGAR	M	9205	1	1	1	1	2	1	4	1	1	2	1	2
43	RAJATHI	F	9216	1	1	1	1	2	1	4	1	1	2	1	2
44	RAMESWARI	F	9258	1	1	1	1	2	1	4	1	1	2	1	2
45	KATHIRVEL	M	10984	1	1	1	1	2	1	4	1	1	2	1	2
46	THIRTHALAGAR	M	12648	1	1	2	1	2	2	4	1	1	2	4	2

47	MOHAMEDSITHIK	M	12649	1	1	2	1	2	2	4	1	1	2	4	2
48	RANJITH	M	15038	1	1	2	1	2	2	4	1	1	2	4	2
49	PRITHIVRAJ	M	15816	1	1	2	1	2	2	4	1	1	2	4	2
50	RAMYA	F	15896	1	1	2	1	2	2	4	1	1	2	4	2
51	RAJESH	M	17606	1	1	2	1	2	2	4	1	1	2	4	2
52	ARUNRAJ	M	24419	1	1	2	1	2	2	4	1	1	2	4	2
53	ARUNA	F	24467	1	1	2	1	2	2	4	1	1	2	4	2
54	KARUPPAIAH	M	24440	1	1	2	1	2	2	4	1	1	2	4	2
55	DHAMODHAR	M	26123	1	1	2	1	2	2	4	1	1	2	4	2
56	SURESHKUMAR	M	26075	1	4	2	1	2	2	4	1	1	2	4	4
57	PRIYA	F	26096	1	4	2	1	2	2	4	1	1	2	4	4
58	SHAKULHAMED	M	27817	1	4	2	1	2	2	4	1	1	2	4	4
59	DEVI	F	27877	1	4	2	1	2	2	4	1	1	2	4	4
60	ALDRIN	M	22955	1	4	2	1	2	2	4	1	1	2	4	4
61	RAMU	M	27718	1	4	2	1	2	2	4	1	1	2	4	4
62	SULTHAN	M	294668	1	4	2	1	2	2	4	1	1	2	4	4

63	BABU	M	31228	1	4	2	1	2	2	4	1	1	2	4	4
64	BHAGAVATHI	M	31256	1	4	2	1	2	2	4	1	1	2	4	4
65	MANIRAJ	M	24314	1	4	2	1	2	2	4	1	1	2	4	4
66	RAJAM	F	24353	2	4	2	1	2	2	4	1	1	2	4	4
67	SURULI	M	25237	2	4	2	1	2	2	4	1	1	2	4	4
68	SUMATHI	F	28388	2	4	2	1	2	2	4	1	1	2	4	4
69	CHINNASAMY	M	29187	2	4	4	1	4	2	4	1	1	2	4	4
70	PALANISAMY	M	29187	2	4	4	1	4	2	4	1	1	2	4	4
71	MARIAPPAN	M	29778	2	4	4	1	4	2	4	1	1	2	4	4
72	KALIMUTHU	M	30809	2	4	4	1	4	2	4	1	1	2	4	4
73	RATHINAVEL	M	32537	2	8	4	1	2	2	8	1	1	2	4	4
74	PONRAJ	M	32924	4	8	4	1	2	2	8	1	1	2	4	4
75	MANOKARAN	M	30554	4	8	4	2	4	2	8	1	1	2	4	4

Operative Scoring

S.NO	Operative Severity	Multiple procedure	TBL	Peritoneal Soiling	Cancer	Mode of Surgery
1	2	1	2	2	1	4
2	2	1	2	2	1	4
3	2	1	2	2	1	4
4	2	1	2	2	1	4
5	2	1	2	2	1	4
6	2	1	2	2	1	4
7	2	1	2	2	1	4
8	2	1	2	2	1	4
9	2	1	2	2	1	4
10	2	1	2	2	1	4
11	2	1	2	2	1	4
12	2	1	2	2	1	4
13	2	1	2	2	1	4

14	2	1	2	2	1	4
15	2	1	2	2	1	4
16	2	1	2	2	1	4
17	2	1	2	2	1	4
18	2	1	2	2	1	4
19	2	1	2	2	1	4
20	2	1	2	2	1	4
21	2	1	2	2	1	4
22	2	1	2	2	1	4
23	2	1	2	2	1	4
24	2	1	2	2	1	4
25	2	1	2	2	1	4
26	2	1	2	2	1	4
27	2	1	2	2	1	4
28	2	1	2	2	1	4
29	2	1	2	2	1	4

x

30	2	1	2	2	1	4
31	2	1	2	2	1	4
32	2	1	2	2	1	4
34	2	1	2	2	1	4
35	2	1	2	2	1	4
36	2	1	2	2	1	4
37	2	1	2	2	1	4
38	2	1	2	2	1	4
39	2	1	2	2	1	4
40	2	1	2	2	1	4
41	2	1	2	2	1	4
42	2	1	2	2	1	4
43	2	1	2	2	1	4
44	2	1	2	2	1	4
45	2	1	2	2	1	4
46	2	4	2	2	1	4

47	2	4	2	2	1	4
48	2	4	2	2	1	4
49	2	4	2	2	1	4
50	2	4	2	2	1	4
51	2	4	2	2	1	4
52	2	4	2	2	1	4
53	2	4	2	2	1	4
54	2	4	2	2	1	4
55	2	4	2	2	1	4
56	2	4	2	2	1	4
57	2	4	2	2	1	4
58	2	4	2	2	1	4
59	2	4	2	2	1	4
60	2	4	2	2	1	4
61	2	4	2	2	1	4
62	2	4	2	2	1	4

63	2	4	4	2	1	4
64	2	4	4	2	1	4
65	2	4	4	2	1	4
66	2	4	4	4	1	4
67	2	4	4	4	1	4
68	2	4	4	4	1	4
69	2	4	4	4	1	4
70	2	4	4	4	1	4
71	2	4	4	4	2	4
72	2	4	4	4	2	4
73	2	4	4	4	2	4
74	2	4	4	4	2	4
75	2	4	4	8	1	4

ABBREVATIONS USED

APACHE II	Acute Physiology and Chronic Health Evaluation
ASA	American Society of Anaesthesiologists
COAD	Chronic Obstructive Airway Disease
G/dl	Grams per deciliter
J-POSSUM	Jabalpur Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity
Min	Minute
MmHg	Millimetre of Mercury
Mmol /l	Millimoles per litre
POSSUM	Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity
P-POSSUM	Portsmouth Physiological and Operative Severity Score for the enUmeration of Mortality and morbidity
ROC	Receiver Operator Characteristic
x2 test	Chi square test